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Hidden Dangers.

THE idea that electricity in some form or other may be applied to the body with beneficial results has possessed the layman ever since that mysterious agency has been available to his hand; and the temptation to apply such treatment to himself, without the advice of a medical man, has frequently been too powerful for him to resist—with fatal results in some cases. A notable instance of this tendency was the popularity of the "Harness belt" some 30 years ago, a device which was shown by this journal at the cost of a series of hard-fought libel actions to be electrically useless; the vendors of the belt had reaped a rich harvest from the simple folk who put their faith in the marvellous healing properties claimed for the belts, which professed to contain electric batteries of the "Voltaic pile" type, but were often not completely connected up to form an electric circuit, and in any case had no curative value at all, such benefits as the wearers experienced being due not to electricity, but to faith and flannel.

The Harness belt, however, was at least harmless, except to the pocket of the purchaser (though many poor wretches whose lives might have been saved by proper medical attention were deluded to their destruction by specious promises of betterment), the same cannot be said of some of the powerful and effective instruments that are now available to the public. That electricity in therapeutics has proved itself of immense value in a variety of ways is, of course, beyond question; but we wish to emphasise the fact that such treatment should never be undertaken except under competent medical supervision.

Experimenting with X-rays has entailed painful consequences to many an amateur, and apart from the danger of X-ray burns which may result in the loss of limbs and eventually of life, there are strong reasons for restricting the use of this very potent radiation to the hands of experts worthy of that trust. That a word of warning is not superfluous may be gathered from recent correspondence in the lay Press regarding the use

of X-rays in shoe shops, for the purpose of revealing to customers the disposition of the bones of their feet when correctly fitted with suitable footwear. The intention is good, but the operation is unnecessary; and though the makers claim that the apparatus is so designed as to safeguard against any harmful effects to either the customer or the operator, the fact remains that the element of danger is present, particularly to the latter, who is constantly exposed to the effect of any stray radiation that may occur. Such effects are cumulative, and may not be revealed for many years after the mischief has been done. Nor is it at all certain that all the dangers associated with X-rays have yet been identified.

In our last issue Dr. W. S. Hedley outlined the history of the use of X-rays in therapeutics, and described the elaborate precautions that had been adopted to guard against the dangers surrounding the X-ray tube—in spite of which from time to time we still have to record another martyrdom; and he gravely questioned whether every medical man who handled these rays in a professional capacity was fully conversant with their properties and their attendant risks. In his opinion no-one but a qualified man should apply the X-rays to the living body.

Again, according to the *Weekly Dispatch*, only last week a man who was in the habit of treating himself with "artificial sunlight" fell asleep in the act, and was exposed to the radiation, presumably containing ultra-violet rays, for an hour and a half; he woke up to find that his skin had peeled off, and has been seriously ill ever since the mishap. Many people treat themselves in this way, and are liable to similar consequences. It is indeed fortunate that radium is too expensive to become the plaything of hypochondriacs—its unsuspected capacity for burning the skin was the cause of some serious occurrences in the early days, when a man would innocently carry a tube containing it in his waistcoat pocket.

In another direction the uncontrolled use of electricity presents real risks: we refer to the electric toys which are now exposed for sale. Some of these are intended for connection to the lighting circuits, which are more often than not at a pressure of more than 200 volts. A lamp is to be inserted in series with the toy, but it should be realised that when the circuit is open, though there is no current, the full pressure is present up to the point of interruption. Moreover, the lamp may be replaced by some ingenious substitute which removes even that safeguard. In any event, the practice is altogether too dangerous, and it should be made a criminal offence to place such toys in the hands of children, who are thus exposed to the double risk of fire and fatal shock.

The Electrical Trade Section at Birmingham.

WE are pleased to report that so great has been the measure of support promised in connection with the Birmingham Section of the British Industries Fair that a large extension to the permanent exhibition buildings at Castle Bromwich has been found necessary. The progress of the Electrical Trade Section, to which we have made frequent reference, is partly responsible for this, and in addition the general engineering trades of the country are participating on a much larger scale than on any previous occasion. The enlargement that has been decided upon is to take the form of an entirely new building on vacant ground between two existing buildings which are at present connected by two corridors. With these three buildings thrown together there will be one vast display hall with an area approximating to 100,000 sq. ft., a considerable part of which will be occupied by the Electrical Trade Section. This section is, as our readers know, the outcome of a conference held at the Birmingham Chamber of Commerce, and electrical companies and firms have come forward in very satisfactory numbers taking considerable space for both trade and working exhibits. We gave a list of exhibitors last week, and this has to be supplemented by a number of others including, we understand, Messrs. Veritys, Ltd., the Hackbridge Electric Construction Co., Ltd., and Callender's Cable & Construction Co., Ltd. In addition to the trade exhibits there will be a worthy demonstration by the Birmingham Corporation Electric Supply Department, while there is also a permanent electricity supply transforming plant provided by that department in the exhibition buildings.

Every effort is being made to add to the practical electrical interest of the occasion (February 15th to 26th) by the organisation of a series of electrical conferences on subjects connected with electrical development, and invitations to be present at some of the functions have been issued to the associations representing the electrical manufacturers, the contractors, the wholesalers, municipal electrical engineers, consulting engineers, the cable-makers, the lamp manufacturers, also the electric power companies, the chief officials of the London electric supply companies, the Provincial Electric Supply Committee, and, of course, representatives of the I.E.E. The fact that Mr. Chattock, the president of the Institution of Electrical Engineers, is Chief of the Birmingham electricity undertaking, which is so closely interested in the Castle Bromwich Fair, is a very happy coincidence.

It will be gathered from the foregoing that all goes well with the arrangements for ensuring a successful electrical twelve days next month at Birmingham. By the date of the visit of the Duke of York, on or about February 18th, there will probably be a live electrical trade market in existence which large numbers of our readers would do well to enter in their diaries straight away.

French Power-station Practice.

IN France, as elsewhere, power-station practice has developed in the direction of the use of larger generating sets. Steam pressures have gone up, but not to the same extent as in Germany. The American system of very large generating sets made up of two or three pressure-stage turbines on parallel shafts has not made headway, and the output of 3,000-rev. turbines has not been pushed as far as with us. The Ljungström turbine, which in medium sizes has proved to be a remarkably economical machine in this country, has not been used in France to any extent. In output, the largest stations are those of Gennevilliers and Saint Ouen, near Paris; the former is of 340,000-kW capacity, and the latter is being enlarged to the same output. Whilst Gennevilliers contains more innovations, perhaps St. Ouen would appeal more to British engineers.

We continue in this issue the description of a station at Comines, near Lille, the design for which was prepared after the Armistice. The layout is arranged for 25,000-kW generating sets, the steam pressure being approximately 300 lb. with 700 deg. F. total temperature. The generators, working at 10,500 volts, are coupled to single-phase transformers, which raise the voltage to 45,000, at which pressure the switching is done. Power is taken by overhead mains to the outskirts of Lille and Tourcoing and is carried finally to the main sub-stations by single-core cables. Among the interesting features may be mentioned the analysis and mixing of the coal from various collieries, the simple appliances for ash disposal, the adoption of two armoured concrete condensing pressure mains to avoid deep trenching in bad ground for the construction of open channels, the use of distilled water from quadruple-effect evaporators for boiler and transformer cooler make-up, the successful use of pulverised low-grade coal, and the simplicity of the switchgear. The station, as a whole, strikes one as being a well-thought-out engineering job, and a credit to those responsible for it. The French, who are leaders in the use of armoured concrete, believe in light and air where power-station buildings are concerned, and a new lay-out facilitates this practice, of which Comines is a good illustration.

Australian Industrial Progress.

A LARGE part of the report by Mr. R. W. Dalton, Senior Trade Commissioner in Australia, which we review in this issue, is devoted to the consideration of the Commonwealth's industrial expansion. This is being sedulously fostered by a system of tariffs which, whether strictly economic or not, has certainly encouraged the establishment of Australian factories—some of them by well-known English concerns. It is not clear from the report how the Australian electrical industry is faring, but it is certainly true that imports of electrical goods, particularly from Great Britain, continue to increase, so that it may be said that the rate of expansion of the home industry is lower than the rate of growth of the demand.

Mr. Dalton endeavours to make clear the conditions governing the preferential admission of British goods into Australia, a matter regarding which there is a great deal of misapprehension. Another useful feature of the report is the advice as to agencies—not a simple matter in a country with an area of nearly three million square miles, and only about six million inhabitants.

An important factor in the engineering trade, although it is not mentioned in Mr. Dalton's report, is the bias for products of a certain country inevitably gained by the student who later becomes a purchaser of machinery or an adviser to purchasers. In the case of Australian student engineers, America fully realises her opportunities, and American manufacturers provide numerous facilities for young Australians who are embarking upon an engineering career. The Sydney correspondent of the *Daily Telegraph*, commenting upon this matter recently, said that British firms appeared to be less eager to afford these facilities. One obstacle which confronted the Dominion student in England was the reluctance of firms to pay a living wage, while there was no difficulty in securing this in the United States. The assertion is rather a sweeping one, for we believe that there are firms in this country who realise the value of early impressions gained by students, and afford the latter facilities of the kind mentioned. At the same time there is plenty of room for improvement, and we urge electrical manufacturers to give their fullest and most sympathetic attention to the matter.

Commercial Matters.

WE are glad to note that certain of the institutions and associations are to some extent filling the gap that has long existed in the programmes of electrical discussions. Technical debates are essential for technical men, and the more there are of them the better it will be for engineers. But there are thousands of men connected with the electrical trade and industry who have little interest in purely technical subjects. For several years we have had evenings devoted to what are described as salesmanship conferences, and there have been attempts to promote non-technical discussions at informal meetings of the Institution of Electrical Engineers. But we are convinced that there are many men on the commercial side of the industry who would welcome an opportunity of putting their heads together regarding the matters that are vital to them in their everyday business-getting efforts. Is it that they have no platform? Or that there are few of them possessed of initiative or gifted with the ability to express themselves? Or are they afraid of giving something away?

Mr. J. W. Beauchamp went to Manchester last week to a meeting of the North-Western Centre of the I.E.E. to lecture on co-operative business building for the electrical industry, and we understand that he directed attention to some of the directions in which the industry is neglecting opportunities—a fine subject in connection with our admitted backwardness in pushing domestic electric apparatus such as the electric washing machine, the household refrigerator, the vacuum cleaner, and—in another department—industrial heating. To-night the British Electrical Development Association holds a meeting, open to all and sundry who wish to listen to an instructive talk from Mr. Ll. B. Atkinson on "Suggestion and Auto-Suggestion in Salesmanship." Our selling methods are an important matter to the commercial man whose business it is to deal with the trader and with the buyer, and if the men who are daily in the thick of the fight could be induced to get on their legs and let their tongues run freely there might be more life and vivacity in trade—who knows?

The Junior Institution of Engineers listened to an address entitled "Notes on Salesmanship" from Mr. A. J. Simpson, the chairman, on Friday last, a brief reference to which appears in our "Business Notices" to-day. The title is a very comprehensive one; perhaps for the purposes of useful or practical discussion it will ere long be found to be too broad, and will be split up into details. The points touched upon in our report show how full of interest the subject may become when we try to look at it as a practical trade subject. Perhaps we need to come down from the clouds a bit when we discuss such matters. There are salesmen and salesmen, just as there are buyers and buyers. There is room for all sorts, and if we try to set up an artificial standard of qualifications, we may discourage good men who never can conform to it. Many of the best qualifications of a business man are those gained by practical experience roughing it on the road and for a time inside the works where the goods are produced. Add to such experience personality, energy, and tact, and little more is needed for the sale of most manufactures.

Overhead Line Regulations.

TRAVELLERS on the Continent cannot fail to observe that there the overhead electric light and power line is as common a feature of the country villages and roadsides as in this country it is rare. This is due, probably, to the fact that here more than anywhere else the use of underground mains has been almost universal and public opinion has not been accustomed to overhead conductors for electricity supply.

At present our regulations for low-pressure lines (not exceeding 650 V d.c. and 325 V a.c.) specify that allowance shall be made for a wind of 50 miles an hour at right angles to a line at 22 deg. F. coated with ice having a radial thickness of $\frac{1}{4}$ inch, and that the pressure shall be calculated on the whole projected area of ice-coated line. In this country all these four conditions might occur simultaneously, say, once in ten years at a few exposed localities. To cope with this remote contingency not only must the cost of all such lines as are constructed be very heavy—in thousands of cases it will forbid their construction absolutely. Again, the minimum height must not be less than 20 ft., though bridges need not be higher than 17 ft. The importance of reducing the minimum height for electric lines to 17 ft. is far greater than might appear; not only would it reduce the overturning moment on the poles, due to wind pressure, and thus enable lighter as well as shorter poles to be used—it would also facilitate negotiations for crossings with the Post Office, and the aggregate saving would be very considerable. Precautions have to be taken to earth broken wires and to trap leakage. For higher pressures the regulations are still more stringent, especially where lines run along or across public roads and railways, or near other overhead lines, or near buildings, including those served.

In country districts, too, the enforcement of the urban regulation restricting pressure variations to a maximum of 4 per cent. up or down is inappropriate. Wider variations must necessarily be allowed. The essential is to cheapen the supply to the country dweller, even at the expense of uniformity of pressure and reliability of supply. It is well to aim at perfection, but foolish to reject everything that falls short of that ideal.

Electricity Supply in Great Britain.—IX.*

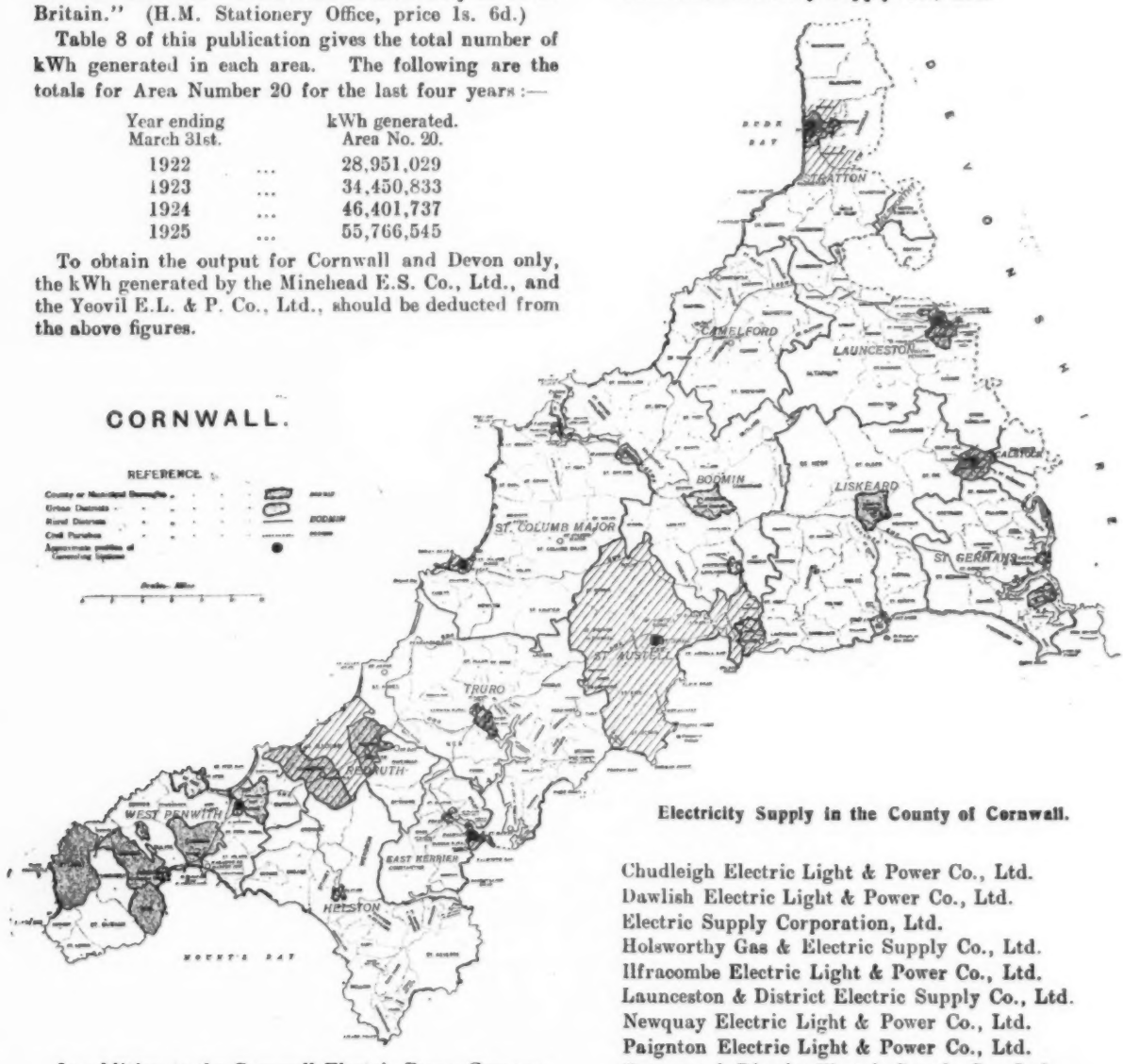
Cornwall and Devon.

No part of either Cornwall or Devon has yet been included in any Electricity District, but these two Counties, together with such parts of Somerset as are not included in the Lower Severn Electricity District as provisionally determined by the Electricity Commissioners, form Area Number 20 in the Annual Analyses and Summaries of "Generation of Electricity in Great Britain." (H.M. Stationery Office, price 1s. 6d.)

Table 8 of this publication gives the total number of kWh generated in each area. The following are the totals for Area Number 20 for the last four years:—

Year ending March 31st.		kWh generated. Area No. 20.
1922	...	28,951,029
1923	...	34,450,833
1924	...	46,401,737
1925	...	55,766,545

To obtain the output for Cornwall and Devon only, the kWh generated by the Minehead E.S. Co., Ltd., and the Yeovil E.L. & P. Co., Ltd., should be deducted from the above figures.



Electricity Supply in the County of Cornwall.

In addition to the Cornwall Electric Power Company, which has certain powers over nearly the whole of the County under the Cornwall Electric Power Act, 1902, there are 27 other authorised undertakers (whose areas are shown hatched on the maps) holding statutory powers for electricity supply in Cornwall and Devon.

The following is the list:—

Local Authorities.

Barnstaple Corporation.
Crediton Urban District Council.
Exeter Corporation.
Plymouth Corporation.
Sidmouth Urban District Council.
Tiverton Corporation.
Torquay Corporation.
Truro Corporation.

Companies.

Bideford & District Electric Supply Co., Ltd.
Brixham Gas Company.
Bude Electric Supply Co., Ltd.
Budleigh Salterton Electric Light & Power Co., Ltd.
Callington & District Electric Supply Co., Ltd.
Camborne Electricity Supply Co., Ltd.
Chudleigh Electric Light & Power Co., Ltd.
Dawlish Electric Light & Power Co., Ltd.
Electric Supply Corporation, Ltd.
Holsworthy Gas & Electric Supply Co., Ltd.
Ilfracombe Electric Light & Power Co., Ltd.
Launceston & District Electric Supply Co., Ltd.
Newquay Electric Light & Power Co., Ltd.
Paignton Electric Light & Power Co., Ltd.
Penzance & District Electric Supply Co., Ltd.
St. Austell & District Electric Ltg. & Power Co., Ltd.
Seaton & District Electric Light Co., Ltd.
Teignmouth Electric Lighting Co., Ltd.
Urban Electric Supply Co., Ltd.

With regard to the Company undertakers, it should be noted that the Electric Supply Corporation, Ltd., has undertakings each with its own generating station at Exmouth, Falmouth and Totnes. Similarly the Urban Electric Supply Co., Ltd., has an undertaking with its own generating station at Dartmouth, also supplying Kingswear; as well as separate undertakings at Illogan and Redruth, obtaining a bulk supply from the Cornwall Electric Power Company.

The Power Company also gives a bulk supply to the Camborne E.S. Co., Ltd., and to the Penzance and District E.S. Co., Ltd., and is arranging to supply in bulk to the Truro Corporation.

* Parts I-VIII of this series appeared in the ELECTRICAL REVIEW of October 9th, 16th, 23rd, and 30th, November 13th and 20th, and December 11th and 25th, 1925.

We understand that Crediton Urban District Council will obtain a bulk supply from Exeter Corporation.

All the other undertakers possess generating stations, as indicated on the accompanying maps.

The generating station of the Cornwall Electric Power Company is situated at Hayle, and Torquay Corporation's new power station is at Newton Abbot.

These maps, which were prepared by the Ordnance Survey Department for the Boundary Commission of 1917, are used by permission of the Controller of H.M. Stationery Office. Since 1917 the following alterations have been made:—

(1) The Parish of Forrabury and the Parish of Minster have been united to form the new Parish of Forrabury and Minster.

Electricity Supply in the County of Devon.

At the present time there does not appear to be any application for new territory in Cornwall, but the Fifth Annual Report of the Electricity Commissioners gives particulars of several applications in Devon. Another application which includes part of this County appeared in the London *Gazette* of May 19th, 1925 (page 3386). The area applied for in the County of Devon is there described as the Urban District of Axminster, the Parishes of Axminster Hamlets, and Chardstock, in the Rural District of Axminster. This area has been hatched on the map, as well as the other areas applied for previously.

The 1921 Census gives the following particulars for the Administrative Counties of Cornwall and Devon and the associated County Boroughs:—

Acres.	Persons.	Resident families.	Buildings not containing dwellings.
2,539,531	1,030,319	251,828	15,845

(2) The Parishes of Budock Urban, Falmouth Borough and Falmouth Town have been united to form the new Parish of Falmouth, co-extensive with the Borough of Falmouth.

(3) The Parishes of Lawhitton Urban, Saint Mary Magdalen, Saint Stephens by Launceston Urban, Saint Thomas the Apostle Urban and the Hamlet of Saint Thomas Street have been united to form the new Parish of Dunheved otherwise Launceston, co-extensive with the Borough.

(4) The Parishes of Tor Moham and Saint Mary Church have been united to form the new Parish of Torquay, co-extensive with the Borough of Torquay.

(5) Parts of the Parishes of Saint Austell Rural and Saint Mewan have been added to the Urban District of Saint Austell and the Parish of Saint Austell Urban.

X-ray Dermatitis Cure.—It is reported by the *Daily Mail* that Professor M. d'Arsonval, in a communication to the French Academy of Science, claims that growths caused by X-rays can be cured rapidly by high-frequency electric currents.

The Comines Power Station.

A French Central Station using Pulverised Fuel.

By THEODORE RICH.

(*Continued from page* 63.)

Boiler House Equipment.

The boiler equipment is distinctly interesting because with the same type of boiler, chain-grate stokers have been put into competition with pulverisers. The boiler house is in two bays, each 62.5 metres (about 204 ft. 5 in.) long and 28 metres (about 91 ft. 8 in.) wide, placed at right-angles to the turbine house, from which it is separated by means of a sort of alleyway used for pipes, pumps, distiller and tanks (see figs. 15 and 16).

The first section to be built contained 10 boilers, and two boilers have been so far installed in the new boiler house which is placed alongside the former. The main boiler floor is of armoured concrete, and the same construction is used for the coal bins. The house is founded on piles; owing to the fact that each boiler, with economiser, stack, bin, &c., weighs something like 600 tons great care had to be taken to get ample support for the armoured concrete stanchions which carry such a load. The main boiler floor is 5 metres (16 ft. 4 in.) above the basement and general ground level; two expansion joints are arranged lengthwise in the floor.

Each boiler house has coal bunkers of a total capacity of 600 tons, roughly one day's supply. There are 12 Babcock & Wilcox marine type boilers each with 1,000 square metres (10,764 sq. ft.) heating surface, each capable of producing 30,000 kg. (66,100 lb.) of steam under normal conditions, and 40,000 kg. (88,160 lb.) when forced; the normal steam pressure is 21 kg. per sq. cm., or approximately 300 lb. per sq. in.

Each boiler has a superheater of 500 sq. metres (5,382 sq. ft.) surface. The total temperature of the steam is 350 to 370 deg. C. (about 660 to 700 deg. F.). The boilers are fitted with water-level indicators, whistling alarms, and pressure gauges with illuminated dials. A dial pyrometer is fitted to the superheater. The feed is controlled by Copes automatic boiler level regulators. A Green economiser of 560 tubes, each 13 ft. long, is fitted over each boiler, the gases leaving at a temperature of about 200 deg. C. (392 deg. F.). Induced draught apparatus on the Louis Prat system with a double cone chimney reaching to 30 metres (154 ft.) above the economiser house floor, is arranged for each boiler unit, two fans being fitted to each chimney, each driven by a 21-h.p. motor running at 720 r.p.m. A 2½-ton monorail electric traveller made by the firm of Sevory-Bedu is arranged to run down the boiler house, while each line of economisers is served by a 2-ton Morris traveller, so that the tubes can be handled if necessary.

Eight of the ten boilers of the original installation were fitted with triple chain grate stokers, having a combined operating surface of 31.35 square metres, the stokers being driven by a 7.5-h.p. motor; the grates are fitted with a mechanical arrangement of the Besmer type for the removal of slag. Forced draught is applied by three fans per boiler, each giving 750 cubic metres of air per minute, driven by a 21-h.p. motor at 720 revs.

Pulveriser Plant.

Two boilers in the original installation were fitted with pulverisers, on the "Turbo" unit system, the two boilers so far placed in the new boiler house being on the same system. The coal having been broken to a size not exceeding about 1 inch cube before being delivered to the overhead coal bins falls down shoots into the pulverisers. Two pulverisers are placed on the boiler floor in front of each boiler, each being driven by a three-phase induction motor, of 90 h.p., at 1,450 revs. Fig. 5, p. 60, shows a pulveriser opened up. The coal enters by means of a trunk and passes through a variable feed arrangement. There are four beater wheels in series on a shaft revolving at high speed; a fan is placed on the main shaft, at the delivery end. The coal is broken by impact and not by grinding action against the walls. Air is sucked through the machine by the fan, the passage of this air tending to drive the coal towards the wheels, while centrifugal force tends to drive it outwards; by regulating the air supply the fineness of the product can be increased. The coal is sucked out by the fan and blown up a rising leg and comes down again dividing into three branches which slope into the boiler casing (fig. 7); there are, therefore, with two pulverisers, six burners per boiler. They deliver the coal into the furnace; the latter is of such an internal height and dimensions, 180 cubic metres (6,345 cubic feet) capacity, that complete combustion is obtained before the gases pass into the tubes.

When the first two boilers were installed three pulverisers were fitted to each boiler; as a result of adjustment and experiment the pulverising capacity of each machine was increased from 2 tons to 3 tons per hour without increasing the power absorbed, and two were then used per boiler. The normal quantity of coal dealt with by each pulveriser is 2½ tons per hour or 5 tons per boiler. The furnace temperature is 1,300 to 1,400 deg. C. (2,370 deg. F. to 2,550 deg. F.) with 14 per cent. carbon dioxide. The pulverisation is carried to an extent which will pass 65 per cent. through a grid of 200 mesh per lineal inch, 90 per cent. through 100 mesh and 100 per cent. through 50 mesh. The fire brick lining is 57 cm. (22.4 in.) thick, with a layer of diatomite, and then a 5 cm. (2 in.) cavity. The brick, which will resist 1,750 deg. C. (3,180 deg. F.), has a composition of 38 per cent. alumina. The brick linings of the first two boilers installed have been in use for four years, and have given no trouble worth mentioning. The pulveriser boilers are being worked for about 5,000 hours per year.

Each boiler is fitted with two auxiliary fans driven by 16-h.p. motors, but these, however, are only put into use when the boilers are being forced beyond the normal output of 30,000 kg. (66,000 lb.) of steam per hour. Like the boilers with chain-grate stokers, two Prat system induced draught fans are arranged alongside the chimney, but the operation of these is not necessary for combustion, they are only set to work when the dust is being blown out from among the tubes. The operation of the boilers with pulverisers has not given rise to any boiler troubles. There have been no tube failures; the use of distilled water for make-up feed may, however, be one factor in this matter. After experience with two boilers in the original boiler house it was decided to use pulverisation for the extension. The director of central stations of the Energie du Nord Co., M. Orango, holds the opinion that the ample combustion space has a great deal to do with the satisfactory operation. It is found that with this type of stoking apparatus steam can be got up very quickly; the losses through banking up can, therefore, be largely reduced. Practically all the carbon in the fuel is burned up.

Comparison with the Chain Grate Stoker.

A good deal of harm has been done to the cause of many engineering developments, by claims that this or that scheme is a sort of universal pill suitable for all situations, results being heralded which do not pan out in practice. At Comines the coal is delivered from various seams and collieries; it is analysed on arrival and mixed so as to give what experience has shown to be the best results for each type of stoker. The ash content is high, up to 25 per cent., the coal being unwashed; the heating value is about 11,500 B.th.u. per lb. and the volatile matter 15 to 16 per cent. The coal from the dump is handled in a similar way in both cases, it comes down from the bunkers in trunks to the

chain grates and to the pulveriser. The space required in a boiler room does not materially differ with the two systems, as room has to be allowed for chain grates to be drawn out, and the two pulverisers stand in line in front of each boiler. Under conditions ruling at Comines it is found that for each boiler the pulverisers take from 150 to 180 horse power, or about 2.5 per cent. of the output of the boiler, neither the auxiliary fans nor the Prat induced draught ventilators being usually required.

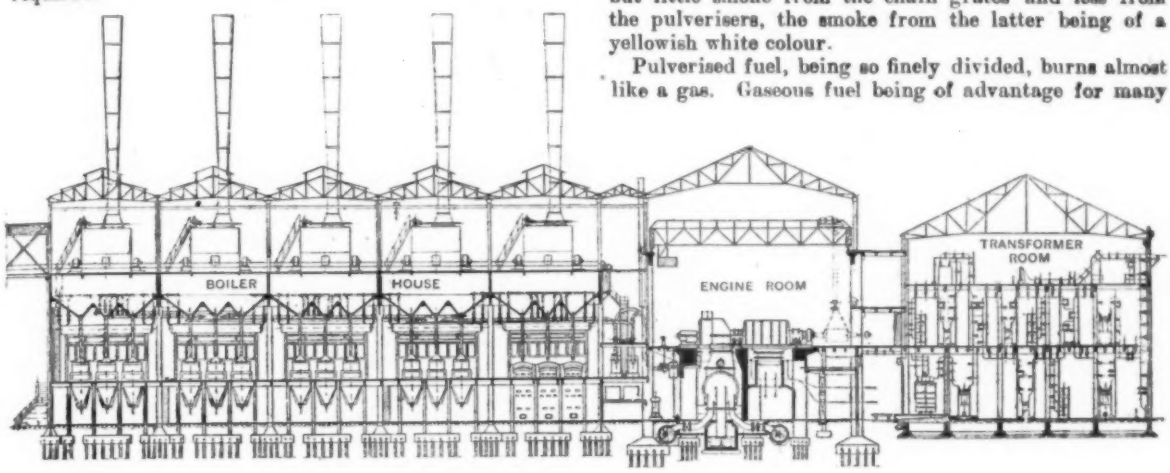


Fig. 15.—Comines Power Station: Sectional Elevation.

With the chain-grate stokers for about the same evaporation the power required is as follows:—Chain grate drive, 7.5 h.p.; three forced draught fans of 25 h.p. each, 75 h.p.; two Prat induced draught fans, 20 h.p. each—total 122.5 h.p., or about 1.9 per cent. of the power of the boilers. The boiler efficiency under test conditions comes out at about 84 per cent. with pulverised fuel and 80 per cent. with chain grates, while under normal running conditions the proportion is about 80 per cent. to 74 per cent. There is also the point that one man drives two pulveriser boilers while one man is put on to each one fitted with chain grates. These figures show that under the circumstances which exist at Comines regarding fuel and operating factors, where efforts are made to get the best results out of each type of stoker, after allowing for the increased power consumption of the pulverisers over the chain grate stokers and fans, there is an ample margin of economy for the former over the latter. It is understood that so satisfied are the users that when the chain grates require renewal they will be replaced by unit system Turbo pulverisers.

Comines power station lies a few hundred yards outside the town of the same name. Except in the direction of the town it is surrounded by open fields. There is but little smoke from the chain grates and less from the pulverisers, the smoke from the latter being of a yellowish white colour.

Pulverised fuel, being so finely divided, burns almost like a gas. Gaseous fuel being of advantage for many metallurgical, ceramic, chemical and other industrial processes, it is of interest to note that in France the makers of this pulveriser have supplied a number for various classes of industrial furnace work; it is only comparatively recently that economy in fuel has been seriously studied in many forms of industrial heating.

The Turbo pulverisers were supplied by a French company, "La Combustion Rationelle," of Paris, the English makers of plant on the same system being Messrs. Clarke, Chapman & Co., Ltd., of Gateshead.

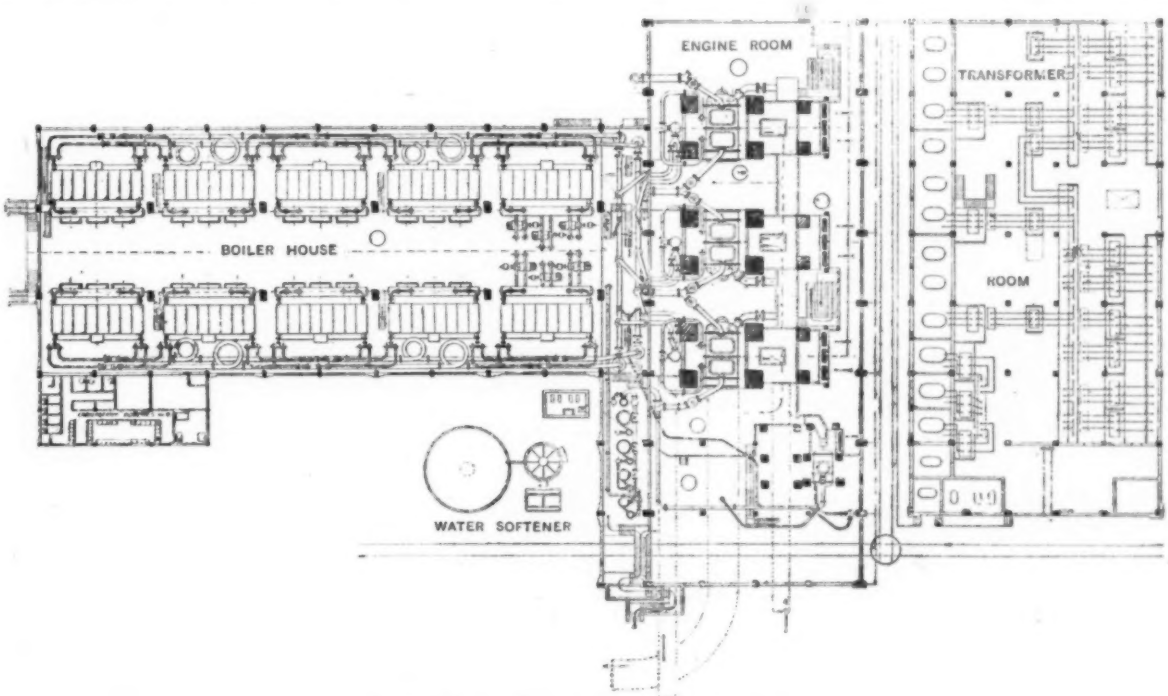


Fig. 16.—Comines Power Station: Plan of First Section.

Circulating Water System.

When the lay-out of the power station as a whole was under consideration, owing to the unsatisfactory subsoil and the urgent necessity for rapid completion, it was decided to avoid as far as possible the excavation

of deep trenches across the site, as not merely would it tend to diminish the stability of the foundation, but also owing to the timbering, pumping, &c., required it would seriously delay the completion of the whole installation, besides being costly.

It was decided, therefore, to put a pump house at the riverside and to install two circulating pressure mains with branches to individual turbines, the flow of water to each condenser being regulated by sluice valves, in lieu of the use of separate circulating pumps for each turbine. A pump house was constructed on the river bank 27.9 metres (91 ft. 6 in.) long and 10.10 metres wide, the floor being 3.2 metres (10.6 ft.) below flood level; the walls, which are of armoured concrete, were made watertight. A ten-ton electric overhead traveller is arranged to handle the plant.

The condenser water flows through double grids into two armoured concrete suction chambers, each having a floor level 2.65 metres (about 8 ft. 8 in.) below the normal level of the river; they are 5 metres (16 ft. 5 in.) wide and have a combined length of 22.8 metres (about 90 ft.). The inlet from the river is 11 metres (36 ft.) wide.

To protect the inlet there is a floating boom arranged with a duck-board so that a man can walk along it to clear away floating rubbish. There are also two sets of grids; the outer one is fixed, and in front of it is a trench for the deposit of mud, which can be washed away by special pumps. The inner grids are arranged so that they can be lifted and cleaned by water jets.

The pump house contains four Rateau type horizontal centrifugal pumps, working up to 12 metres (37 ft. 8 in.) head, two of which usually suffice for the load; each is driven by a three-phase induction motor of 450 h.p. at 730 r.p.m. at 220 volts. Two geared pumps driven by motors are used for priming. The main pumps deliver into a common cross header which can be separated into two parts by a sluice valve, the header being connected at the ends to two armoured concrete pressure conduits of 1.8 metres (5 ft. 11 in.) internal diameter running longways under the turbine house, from which branches controlled by valves are taken to the individual condensers, one branch from each conduit; the condenser discharges flow into a rectangular conduit running under the condenser bodies. Arrangements are made so that as soon as the capacity of the river is exceeded, cooling towers may be erected and the incoming water mixed with suitable proportions of cooling-tower discharge water.

Two 1,000-kW 10,500/220-volt three-phase transformers are placed in an annexe to provide power for the pump house. The transformer cubicles are arranged in a manner similar to those shown in fig. 13, p. 62.

(To be continued.)

Electricity Showrooms.

By W. A. GILLOTT, A.M.I.E.E.

THE question of showrooms for an electricity supply authority is one that, unfortunately, does not receive the attention it deserves, taking the country as a whole. There are comparatively few really good showrooms in existence; where they are in evidence, it is in places where the demand for a supply of electricity is rapidly increasing.

One of the first questions asked when a show-room is suggested is:—"Are showrooms necessary?" It is agreed that a supply authority has a valuable product to dispose of, and by supplying more energy it not only brings profit to itself, but provides means to relieve the monotony of work by the use of labour-saving appliances. The employment of electricity assists to prevent accidents, enables a building to be warmed in a hygienic manner, cooks food, cleans the air, and generally makes for a more healthy race. It is essential, however, that the people who are to receive these benefits, must be shown how they can be obtained by the aid of electricity. There still exists the mistaken belief, that everybody knows that one can cook, heat, clean, wash, &c., by electricity; it is true that a large percentage of the public has *heard* that electricity can be used for such purposes, but it does not *know* it. At a recent electrical exhibition in a town of nearly a quarter of a million inhabitants, many visitors were surprised to learn that electric cookers were actually in use, and the demonstration of an electric bed warmer was witnessed with astonishment. Such instances demonstrate the need of educating the public by direct application. Press advertising is necessary to create the interest; electrical exhibitions fill the part of stimulating that interest; and the showroom, with its congenial surroundings and well displayed appliances, is necessary to secure the order.

Can We Afford a Showroom?

It is not proposed to reply to this question by a plain "yes" or "no," but to give its answer in another way. Above it is shown how necessary it is to have a shop window for the power station to promote the extended use of electricity, and authorities who have not operated an up-to-date showroom cannot realise the business-pulling power which they possess, if properly managed. I have had experience with electricity showrooms where a turnover of some thousands of pounds per annum is done in counter sales—without taking from or upsetting the electrical contractor, and I will refer to him later—in cases where authorities have, or do not have, selling powers, and the result of this is also seen in the yearly returns of output. In one case of which I know, where it had not been the policy to appear in public, it was decided to establish well-appointed showrooms, and by the end of the first year the undertaking was able to trace the effect of this to the tune of nearly a million kWh increase in domestic consumption. In another instance, after showrooms had been opened but a few weeks, the station superintendent reported an appreciable increase in the demand on the station at midday on Sundays, and another undertaking found that it was able to induce shopkeepers to continue their window lighting until late at night. The effect of this showmanship was to earn more revenue, and by encouraging the class of load which the station needed, to materially help in filling up the "valleys" and secure a general improvement in the station costs. The trade slump of 1921 was felt by almost every supply authority, but I know of stations that were able to maintain their profits by an increase in domestic load. It is a fact that whatever the state of industry, people must eat, and it is "up to" the supply authority to see that they eat food cooked electrically. Another aspect is that a consumer has the right to expect (I was going to say require) the supply authority to keep him abreast of the times, show him the benefits of employing electricity, and how to use it to the best advantage, to enable him to extend its use in his home, office and factory, bringing in its wake increased output and profit to the undertaking. An undertaking cannot afford to be without a showroom. It is an excellent form of advertising, producing good results if it is properly managed.

What Form Should the Showroom Take?

Upon the assumption that it is agreed to proceed with a showroom, the next consideration is to be given to its type: this naturally depends upon the class of district covered by the supply authority, and, therefore, local conditions will determine to a large extent the way in

which the building will be equipped or laid out. It may be a palatial establishment complete with an Electric House, model works, kinema, ladies' retiring rooms, lounge with afternoon tea, smoking room with morning coffee, shop windows arranged for each trade in the district, lecture hall, &c.; or, to go to the other extreme, a small shop with a model kitchen behind. Whatever the size of the building, one object must never be lost sight of, that is, the essential feature of exhibiting the goods in as nearly as possible their normal surroundings. Do not show a table standard with its delicate silk standing on top of a cooker, or a bowl fire on a shelf 8 ft. from the floor. If a small shop only is available it requires but a little more ingenuity to reach the necessary standard of dressing. The first care is to see that every section is properly illuminated; the window should have a minimum of 100 W per foot frontage, spot lights, colour lighting, signs, time switches, &c., all fixed in their proper position and shown working. The electric fire needs a suitable base in a fireplace, or if of the dog grate type, it will look better on an open hearth with the mantlepiece complete; the electric iron should be placed on an ironing board; and the cooker in the kitchen. Where space is limited arrangement can be made for dealing with single subjects at different times, leaving, of course, a section free as a general exhibit. Sufficient plugs and switches or other outlets should be fitted; they are all needed for quick demonstration. A client visits the showroom to obtain ideas of how his home or shop may appear when electrified: it should, therefore, be the endeavour to show the appliances performing the work which they are designed to do, so far as circumstances will permit. The showroom should educate the client in a pleasing manner how to use electricity correctly. Apart from this, goods well shown are half sold.

What of the Electrical Contractor?

The electrical contractor is a necessary link in the chain of progress. It will be admitted that there exists in some districts a feeling of unwillingness to get together, but if the subject is properly handled, both sides can secure lasting benefits to their mutual advantage. It is not intended to give schemes of co-operation here, but to any interested body which would like details of such an arrangement, I should be pleased to submit proposals that would secure the desired result. Almost in every district, where a supply of electricity is available, much greater progress could be made if contractor and supply authority worked together, each having the one object in view, *i.e.*, more consumers. The potential business is enormous but, to secure it, capital, vision and goodwill and new methods of marketing are needed, and co-operative working is but one of the procedures to adopt. Each section should do its utmost and stand by its own results after a proper understanding in working methods has been arrived at. There are districts known to us all where such happy circumstances exist; it is the extension of this that will help to bring us nearer really inexpensive installations that all may receive the full benefits that electricity can provide.

The Next Step.

The stage is now reached where these items are to be put into operation; the question of tariffs, hiring schemes, &c., are all agreed upon and premises secured. This is the critical period of the whole situation, and in order to obtain the best possible results, it is advisable to place the whole scheme in the hands of one who is experienced in these matters. If such an individual is not on the staff, he should be found. If this course is adopted, the foundation of increased output, more profit and better service is established.

Electric Fires.

A Few Notes on the Types of Heating Elements.

By A STATION ENGINEER.

IN a recent issue of the ELECTRICAL REVIEW a writer dealing with this season's fires remarked on the multiplicity of designs and questioned the advisability of so many. Undoubtedly, for a comparatively new industry we have far too many types of fires, and when such an old-established industry as the gas apparatus suppliers have found the need to introduce and very extensively advertise a standard model gas cooker and certain standard types of gas fires, surely it behoves the electric fire manufacturers to get together and produce a few standardised models and advertise them in the lay Press. By all means let each manufacturer have complete freedom of action regarding the appearance of the fire, and if they wish, let each manufacturer continue to put any type of heating element he likes on the market, but let us have—and very quickly too—a standardised type of element which, of course, must be of the plug-in type.

As I write I have before me the catalogues of many fire manufacturers running back for some years, and it is amazing to note how many have changed their element designs nearly every season. I may be prejudiced in favour of a particular type of element, but let me say right away that as a supply company engineer with experience in eight different undertakings in various parts of the country, I have yet to come across a burnt-out element where such an element has consisted of a fire-clay former built up in multiple with steel supports of some sort, and the heating spirals wound on *without* any pinning to the fire-clay. Dr. Ferranti has often shown remarkable foresight in design, and whether he was personally responsible for the Ferranti fire or not, the Ferranti fire element was built up of small fire-clay units steel supported, and to my mind was an excellent job. It has not been manufactured for some years now. To-day I can only trace five types of fire elements built up in multiple and two types in which the multiple principle has been partly followed by supporting two or three fire-clay sections on steel. I regret to note that the manufacturers of the last two types are putting them into the background. Second in reliability I have found the old 500- and 600-watt fire-clay bar in which the spiral is run in vertical grooves and hooked on top and bottom. This bar is now being superseded by the 1,000-W bar, and I am afraid it is with the 1,000-W bar that so many makers change their designs frequently. There are several makers who have succeeded in producing a 1,000-W solid bar element and who have so designed the fireclay that no pinning or clipping of the heating spiral is necessary. Why several well known makers who previously made really good 500- or 600-W bars now persist in pining the spirals of their 1,000-W bars to the fireclay, passes my comprehension. Personally, I have had nothing but trouble with this type due to "hot-spots" developing. It is no easy matter to stretch out the spiral to the necessary length, fit it in the grooves and then insert several dozen small split pins and still keep the turns evenly spaced to prevent "hot spots." One maker uses no fewer than 44 small split pins in a 1,000-W bar, and it is an impossibility for the average contractors' electrician to satisfactorily fit a new spiral under 40 minutes.

In referring to my ideal element as a firebar built up in multiple, I do not include the reflector type of element in which some 6 to 12 small fire-clay bridges are fitted in a polished reflector. I believe the reflector type will soon die a natural death, and that any reflector

effect required in any particular design of fire will be obtained by a reflector that is part of the fire frame.

In conclusion, by all means let makers continue to produce their own elements, but at the same time let them get together and decide on a standard plug-in bar, standardised as to distance between centres of the plug-in pins and standardised also as to width. In a few years it should be possible for one to walk into a shop and take home a 500-W or 1,000-W plug-in bar and fit it oneself just as we do with lamps. How often does an electric fire manufacturer advertise his products in the daily Press?—one or two do very occasionally, most of them never. Standardisation should cheapen manufacturing costs, and the pooling of advertising resources should enable frequent announcements to be made in the daily Press. Advertising must be continuous to be successful, and I feed sure that contractors would as a whole be satisfied with smaller trade discounts on well-advertised fires as the turn-over would be so much greater.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

PROMOTED by the Physical Society of London and the Optical Society, this show is an event in the scientific calendar. It is held at the Imperial College of Science, South Kensington (January 5th to 7th, inclusive), and is looked forward to as an opportunity to view the latest products of the leading instrument makers. This year, however, the Councils of the above-mentioned Societies extended the scope of the exhibition, the sixteenth of the series, by including, in addition to the usual trade display (in which some 72 firms participated), three new classes of non-commercial exhibits, namely (*a*) exhibits illustrating the results of recent physical research and improvements in laboratory practice, (*b*) selected examples of effective lecture experiments, and (*c*) repetitions of famous historical experiments in physics.

The object in view, in the case of classes (*a*) and (*b*), was to afford teachers and research workers an opportunity for interchanging ideas and disseminating information on matters relating to their work in practical physics. The exhibits in class (*c*), it was anticipated, would not only interest the scientific worker, but would also be of value as a means of impressing upon members of the general public (who had an opportunity of attending the exhibition on the third day) the connection between the lesser-known fundamental physical phenomena and their more widely-known practical developments.

Amongst the short lectures that had been arranged was one by Prof. A. F. C. Pollard, A.R.C.S., A.M.I.E.E., on "The Mechanical Design of Instruments," and another by Major W. S. Tucker, D.Sc., on "Electrical Listening." The collection of exhibits included several ingeniously constructed novel instruments, and electromedical apparatus was also displayed this year, particularly artificial sunlight lamps.

Cambridge Instrument Co., Ltd.

In accordance with its usual custom, the company had one of the largest displays in the show. Among the electrical instruments we would draw attention to a new electrometer (fig. 1) originally designed by Professors A. H. and K. T. Compton, the principles upon which it is based having already been published. The instrument possesses high sensitivity which can be quickly adjusted to any required value over a wide range, while at the same time it is practically constant over a large range of deflection.

The Duddell oscillograph outfit (fig. 2), first exhibited a year ago in the experimental stage, is now being manufactured for commercial use rather than only for laboratory experiments. It has the advantages of adaptability, robustness, and portability, while the ease with which it is operated adds considerably to its value as a commercial instrument. The outfit is constructed almost entirely of metal; it may therefore be readily moved from one place to another without risk of damage, and can be brought into close proximity with the problem under consideration. The outfit is designed to enable simultaneous records to be obtained from three vibrators, which may be any combination of the electromagnetic and the electrostatic types; in addition, the standard outfit comprises a revolving-drum camera with mechanism for exposing the film or paper, focussing lenses, and a small metal-filament lamp. The uncertainty of operation associated with the electric arc is thus avoided, and in order to obtain the high intensity of illumination required for the photographic recording of the wave form, the lamp is considerably overrun during the period of exposure. By means of a system of rotating mirrors, the wave form under investigation can be observed right up to the moment of exposure.

The vacuum thermo-element designed by Dr. Moll (fig. 3) is based upon the fact that if a thermopile is placed within a vacuum, its sensitivity is considerably increased, while there is also the distinct advantage that disturbances due to air currents are eliminated. Thermopiles constructed in this way have not hitherto yielded the result which might have been

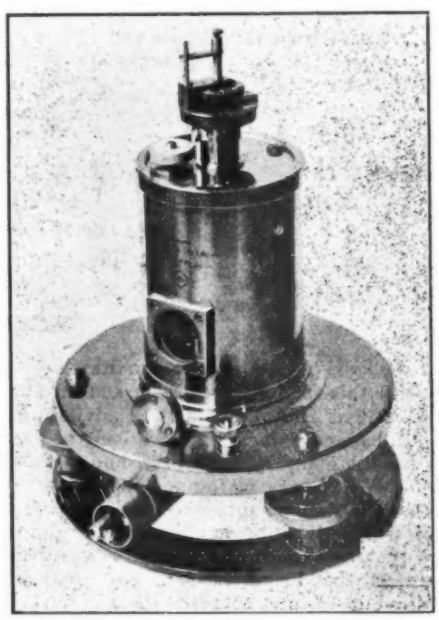


Fig. 1.—A New Electrometer.

expected, owing to the great heat capacity of the thermo-element, but by making use of extremely thin strips of metal, Dr. Moll and Dr. Burger have succeeded in designing a vacuum-element having a sensitivity about 100 per cent. higher than in air. It consists of constantan and maganin strips, brazed together, and blackened on one side; the strip is less than 0.001 mm. in thickness, even at the junction of the two elements, and the thermopile is mounted on platinum wire fused into a glass envelope, which is exhausted to a high degree of vacuity. In order to protect the thermopile against unequal heating, the glass is enclosed in a metal case, having double walls insulated from each other. Windows are provided on opposite sides of the case, that in front being fitted with a worked glass plate, which can be replaced, if desired, by a microscope slide cover glass, or a microscope objective. The window at the rear is fitted with a lens, so that the position of the thermopile may be adjusted relatively to the other parts of the apparatus. This thermo-element is particularly suitable for spectrum work, and is extremely rapid in action, the position of equilibrium being obtained within three seconds of the time of throwing the radiation on to the thermopile.

An electrocardiograph outfit was exhibited in an improved and simplified form, designed for operations from a 12-volt

electric battery. The illuminating source of light is a 50-c.p. half-watt type lamp, and a suitable rectifier, which enables the battery to be recharged from an alternating-current supply, is included.

A vertical force magnetograph with Helmholtz-Gaugain standardising coils, which the Company is supplying to the

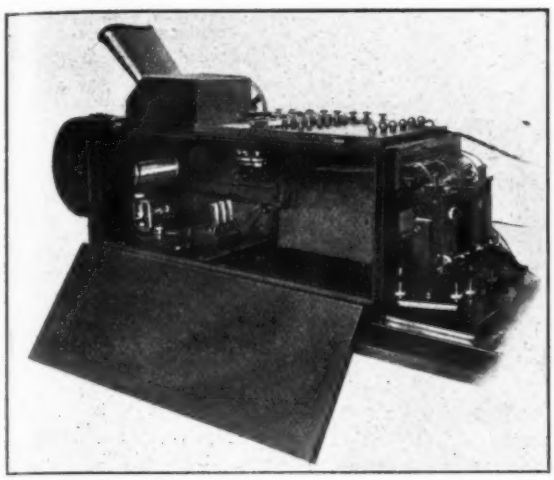


Fig. 2.—Improved Duddell Oscillograph.

Royal Observatory at Hong Kong, is of the Watson type; two tungsten steel magnets, mounted on either side of a platinised quartz mirror, are supported by two quartz fibres stretched in the same plane as the mirror, the system being kept taut by means of a quartz spiral spring. The design provides automatic compensation for changes in temperature, and

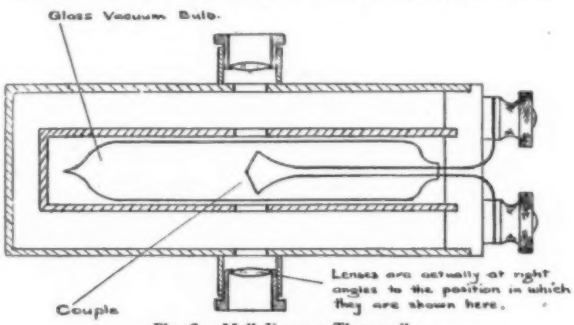


Fig. 3.—Moll Vacuum Thermopile.

the sensitivity is such that approximately 1 mm. is recorded on the chart for a change in magnetic force of 5 γ.

An instrument that should be better known is the "Cambridge" Unipivot galvanometer; this versatile instrument, by fitting a millivolt scale for d.c. and a thermal scale for a.c. work, can be used for the measurement of current or pressure

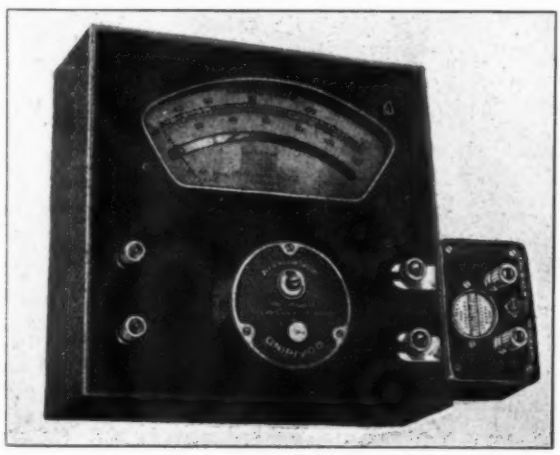


Fig. 4.—"Cambridge" Unipivot Galvanometer.

of either type over a range that can be varied with the aid of easily-attached accessories (fig. 4). Its application may be extended by the use of range multipliers so chosen that the current or pressure being measured is ascertained directly by applying a simple factor to the reading of the galvanometer. The multipliers are arranged for direct connection by means of tongues, as shown, but tapered holes enable connections to be made at a distance by plug-ended leads; they are interchangeable and made to cover ranges of pressure or current, one pattern being arranged for measuring both voltage and amperage without the necessity for changing connections. Alternating current, of high and low frequency, may be measured in conjunction with thermal converters, which are independent of frequency errors. The device consists of a thin wire heater of refractory material, to the centre of which is attached a fine thermo-junction; a.c. passed through the heater raises the temperature, which is measured by the thermo-junction on the millivoltmeter, the deflection being

Fig. 5.—Vacuo-Junction.

proportional to the square of the current through the heater; the heater and thermo-junction are enclosed in a glass bulb (fig. 5). Converters are made in two ranges: one for use in conjunction with a.c. range-multipliers for pressure measurement, and the other for current measurement. For high-frequency work the heater is formed of two 0.05-mm. diameter iron and constantan wires looped together at their centres to form a cross. The accessory has a cover that acts as an electrostatic shield, which is completed by the case of the Unipivot instrument being connected to the moving coil.

The diagram (fig. 6) illustrates a millivoltmeter with a thermal converter (in the centre of the diagram), containing the thermo-junction JT in series with a small adjusting resistance r connected across its tongues. A heater H, together with

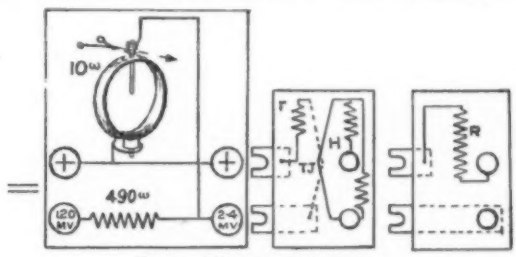


Fig. 6.—Diagram of Connections.

a small shunt and series resistance, is connected between the terminals of the converter. The a.c. range-multiplier (to the right of the diagram) contains a high resistance R in series for reducing the pressure at the converter terminals.

Marconi's Wireless Telegraph Co., Ltd.

In addition to an automatic call key and 4-seconds alarm device, various radio receiving sets were to be seen on this stand. In particular, the short-wave receiver shown in fig. 7, which has a wave range of from 15 to 100 metres, is a reproduction of the experimental apparatus used in Senatore Marconi's yacht for the interception of short-wave signals from

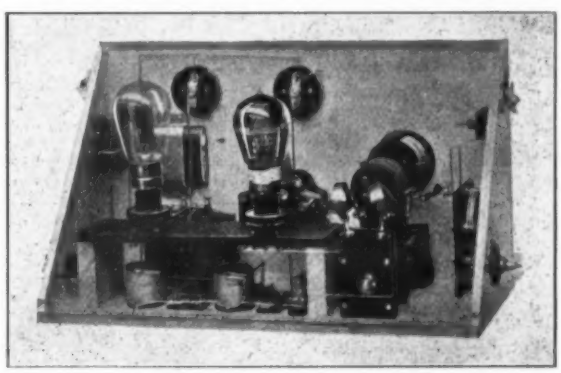


Fig. 7.—Marconi Short-Wave Radio Receiver.

the Poldhu station. Two valves are used, a detector and a low-frequency amplifier, the apparatus being designed to employ Marconi D.E.5 valves. An aerial, either of the "T" or "L" type, 50 to 150 ft. long, is suitable, but it is essential that it should be out of tune with the incoming wave, both as to fundamental and harmonics, and its tuning must always

be over the wave-length to be received. Two sets of tuning coils are supplied, together with a calibration chart for each receiver. The respective ranges of the coils are 15 to 40 metres and 35 to 100 metres. Three 40-volt dry batteries supply the high voltage for the receiver, the detector taking 80 volts and the low-frequency amplifier 120 volts. The broadcast receiver shown in fig. 8 employs no reaction whatsoever. It is composed of five h.f., one detector, and two l.f. stages. Each of the h.f. stages is tuned and separately controlled, adjustments for each being made by rotating the control dials to the wave-length marked on the scales. The circuit is "straight" and has its valve capacities balanced on what is claimed to be a unique method. A volume switch is incorporated in the set. Six D.E.3 and two D.E.5 valves are used, making the total current

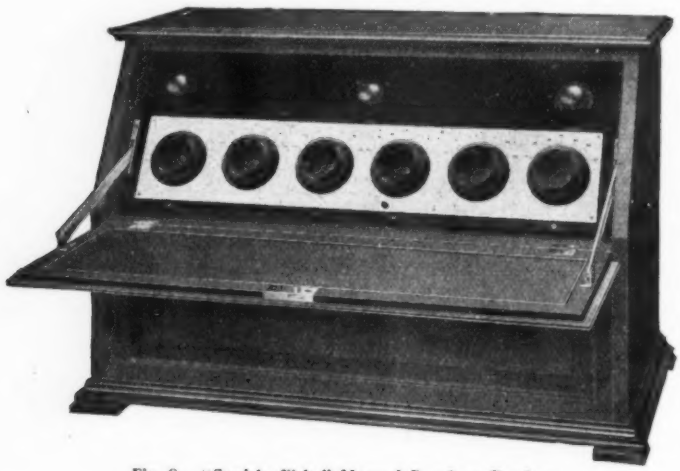


Fig. 8.—"Straight Eight" Marconi Broadcast Receiver.

consumption .63 ampere, using a 6-volt accumulator. Longer wave-lengths than the broadcast band are receivable on this model by additional coils. The h.p. batteries are housed in the base of the instrument; the selectivity is such that reception from stations immediately above or below the London wave-length can be obtained within four miles of 2LO.

(To be continued.)

Electricity Supply in Russia.

VARIOUS subjects were discussed at the Pan-Russian conference of representatives of municipal electricity supply works, which was held in Moscow during the third week in December. Dealing with the general situation of the industry, Mr. V. L. Levi pointed out that out of the 5,258 generating stations throughout the country 693, or over 13 per cent., were municipal or regional stations. The average capacity of the municipal stations was 34 per cent. of the average capacity of all the stations, *viz.*, 767 kW. Almost one-half of the plant was in Leningrad, Moscow and Baku. From 1917 the number of stations began to increase, the augmentation having been specially active in the past year. Down to 1923 the works constructed were principally of small size, but since then the average capacity had been raised to the pre-war level.

Internal combustion engines, the author proceeded to state, occupied a predominating position in the small stations, 50 per cent. of the stations being provided with that type of plant, while steam turbines were employed in the large stations. The total value of the stations amounted to about 220,000,000 pre-war roubles in 1923, and since then a total of 250,000,000 roubles has been expended, principally on regional stations, so that the capital invested in these undertakings has more than doubled in the past year or two. On the average about 27 per cent. of the plant in the works was out of service in 1923, while in 1924-25 the percentage of idle plant was further increased, except in the case of the works in Moscow and Leningrad. This circumstance is said to testify to the fact that the plant in the municipal stations has to a considerable degree become obsolete. As to the question whether the stations succeed in meeting the demand, it was mentioned that the load represented 71 per cent. of the capacity in 1924, whereas in 1925 more than half of the works had been operated without any reserve plant, and 16 per cent. were overloaded. The principal feature of the municipal stations was that their load was mainly lighting, 60 per cent. of them not having any industrial customers, although some improvement in the utilisation of the stations took place in 1924. The speaker expressed his preference for small stations, considering that large works were only of greater advantage where a reasonable demand already existed, which was seldom the case with Russian stations.

Mr. U. K. MITLYAN stated that the main problem of municipal stations consisted in the restoration, reconstruction and extension of the existing stations, and the effective administration of the industry. Funds for capital expenditure must be derived, in the first place, from amounts set aside for redemption, and profits. In individual cases funds could be obtained from consumers in the shape of credits granted or shares taken up in the stations. But the basic source of funds for the establishment of new municipal stations must be the granting of long-term loans by the Central Communist and Electrical Banks, which should organise a consortium for giving credit to municipal stations in conjunction with the Industrial and State Banks. The author held that all the stations should be placed on an economic basis by the charging of adequate tariffs, the organisation of redemption funds, the development of the load, and the preparation of correct forms of accounts.

The fuel question was dealt with by Dr. A. V. Volkenau, who stated that the stations used Donetz coal and liquid fuel to the extent of 47 per cent., local mineral fuel to the extent of 44 per cent., and wood to the extent of 9 per cent. As in the next few years there would be a shortage of coal and naphtha as a result of the development of the metallurgical and other industries, it would be impossible for the municipal stations to obtain all the fuel of high calorific value which they required, and they must therefore devote more attention to the use of local fuels of inferior quality, or pulverised coal.

Mr. I. M. RUSAK spoke of the success which had attended the scheme of one of the Leningrad stations for the supply of hot water to certain undertakings such as hospitals and baths by means of special pipe-work. It was considered that a considerable scope lay in this direction for new stations.

Dealing with the cost of generation, Mr. M. K. POLIVANOFF stated that this was at present far too high. A considerable reduction in expenditure would be rendered possible by the erection of large units, a path upon which the Russians had recently embarked. Thus at the Schatur station it was proposed to install 35,000-kW turbo-generators and machines of from 25,000 to 30,000 kW at the Kaschir station, while machines of the same size were projected for Leningrad. Moreover, the success which had attended the use of peat and Southern Moscow coal had rendered possible the erection of boilers with a large superficial heating surface in conjunction with generators of large size; and reference was also made to the use of pulverised coal. At present the boiler efficiency was very low compared with that which was being obtained in the United States.

Many other questions were discussed at the conference, including the grant of credits to municipal stations during the current year (1925-26).

Electricity on Board Ship.—That modern passenger-carrying liners are usually fitted with large electrical installations is well known, but it is not often realised that cargo ships also use electricity to a considerable extent. The M.V. *Upwey Grange*, the latest addition to the Houlder Line, was built by the Fairfield Shipbuilding & Engineering Co., and is of more than usual interest in that she is said to be the largest and fastest refrigerated cargo vessel afloat. The propelling machinery consists of two 3,200-b.h.p. Fairfield-Sulzer Diesel engines and the ship will be used chiefly for carrying chilled meat between Argentina and London, the refrigerated space provided representing a capacity for 260,000 carcasses of mutton. The whole of the electrical material has been manufactured and supplied by the General Electric Co., Ltd. The generating plant consists of two "Witton" compound-wound d.c. generators, each of 25 kW, at 100 volts, coupled direct to reciprocating engines. The main switchboard consists of two generator and two feeder panels, whence cables run to iron-clad distribution boards in various parts of the ship, from which sub-circuits are run to teak-cased fuse boards for lighting. General lighting is provided by means of Osram ship-type lamps, in addition to a large number of Osram gasfilled lamps. Brass and white-metal pendants with obscured globes are used in the cabins, wellglass fittings for the alleyways and shelter deck lighting, the weather decks being lighted by guarded bulkhead fittings, and the engine room by gasfilled lamps in industrial reflectors. In each cabin a "Freezor" oscillating fan is installed and the dining saloon is ventilated by means of "Wing"-type deck-head fans. Special attention has been given to lighting so that cargo can be handled with the same dispatch at night as during the day. Cargo connection boards of a special pattern are provided, with "Neptune" lanterns and 500-watt gasfilled lamps, in addition to portable cargo lanterns accommodating 100-watt gasfilled lamps. A 7½-h.p. motor is installed in the workshop for driving the machine tools. In the pantry there is a 28-way bell indicator for the bell installation throughout the ship. The cable throughout is of Pirelli-General manufacture.

The Metallic Arc Welding of Cast Iron.

Particulars of the Technique to be followed.

By P. L. ROBERTS.

ONE of the most vexed and discussed subjects in the particular section of the engineering world concerned is the welding of cast iron. It is an exceedingly controversial subject, largely because the majority of engineers know little or nothing of the technicalities involved, and base their opinion entirely on their experience of the results. A great deal of indifferent and really bad welding has been done simply because the whole process has been entrusted to operators who have had no proper training and whose little knowledge is empirical. Then engineers, seeing only the poor results, condemn welding. This is just as sweeping as is the condemnation of electricity because one has had poor service from a particular type or make of electric motor! Research work combined with long and close observation of various methods of welding cast iron and the attendant results, have established the process on a firm basis of reliability. It is possible to state definitely beforehand, by visual examination, the possibility of successfully welding any particular iron casting. This, of course, requires the knowledge gained by intimate experience of such work.

Much has been written about the remarkable repairs effected by the metallic arc welding of cast iron, but little about the actual methods or technicalities involved. It is essential to have some knowledge of the physical properties of cast iron to appreciate the difficulties involved and the nature of the results obtained by welding. The chief difficulty in the welding of cast iron arises where expansion and contraction cannot take place freely, as cracking occurs due to the brittle nature of the metal. This brittleness, or entire lack of ductility, is well known as an inherent property of cast iron, and is caused by the large amount of free carbon, or graphite, in the metal. The graphite separates in flakes round the grain boundaries during and after the solidification of the cast metal, so causing separation in the iron. The tensile strength of cast iron, therefore, is only equal to the tensile strength of the "cement" formed by the graphite flakes between neighbouring crystals. The tensile strength, as a result, is low, as would be expected, and the ductility (stretching without fracture) practically nil. The natural consequence of this lack of ductility is that fracture will occur in or near a welded portion of cast iron in cooling, unless free to contract. For instance, assume a weld to have been made over a small area of a large piece of metal. The weld, in cooling from its molten to normal temperature, must contract. The weld has now become a part of the whole, but must contract independently of the whole, because heating has only been applied at the weld and not to the body of the metal. The result is that considerable stress is set up during cooling. If, however, the weld and welded part is steel or similarly *ductile* metal, it will stretch under the force of contraction, *without* fracture. In the case of cast iron, however, the force exerted due to contraction causes fracture of part or the whole of the portion which is cooling, because of the lack of ductility mentioned.

In practice the welded portion of a casting may be stronger than certain other parts, so that on cooling, the force of contraction will cause fracture at one or other of these parts. There are a number of ways of overcoming this, the greatest difficulty in the welding of cast iron, and they will be described later.

Another important effect on the cast iron due to the large amount of carbon present is that of chilling. The carbon content of cast iron varies from 3 to 4 per cent., which is all in solution, or combined with the iron, when the latter is molten. If the metal is cooled suddenly from that state, the carbon remains in the combined form, causing very considerable hardness of the metal. Such an iron is known as white iron, and cannot be machined in the usual way, grinding alone being effective. Slow cooling, or cooling in a temperate indoor atmosphere, from the molten stage to below a dull red temperature, will enable the carbon to separate from the iron, to form flakes of graphite as the cooling progresses. Slow and prolonged cooling will cause grain growth, and the larger the grain the weaker the iron. It is necessary, therefore, if the best results are to be obtained, to cool neither too quickly nor too slowly. The correct condition is realised when the metal is allowed to cool in air in a place free from draughts. Hence, after welding cast iron, the condition of cooling is arranged to meet as nearly as possible that indicated.

The methods of welding cast iron by the metallic arc may be divided into two classes: "The cast-iron electrode method" and "The mild steel electrode method."

The Cast-Iron Electrode Method.

In welding any metal it is always desirable that the weld should possess so far as is possible the same physical properties as the parent metal. In the particular case of cast iron, the physical properties of the weld can be made to correspond very closely with those of the casting. It is necessary, however, to preheat the whole or part of the casting before attempting to weld. The preheating is essential, when welding with a cast-iron electrode, to prevent cracking due to the contraction stresses set up, and to provide the means of slow cooling to ensure a grey iron weld, as previously indicated. The choice of whether a casting shall be partially or wholly preheated depends entirely on the position of the break and the type of casting. If the welded portion is perfectly free to contract on cooling, it is only necessary to preheat the casting across the broken section, simply to ensure that the deposited metal will not be chilled, resulting in a hard deposit. This is the simplest case, and the welding can always be made a successful piece of work. In cases where the welded portion is not free to contrast, preheating has also to serve the purpose of preventing contraction cracks. It will readily be seen that if the whole of the casting is heated, kept at a high temperature during welding, and then the weld allowed to cool slowly with the casting, no stresses will be set up, as contraction takes place uniformly throughout the whole mass. It is only necessary to heat the casting to a dull red (about 500 deg. C.) and maintain that temperature during welding, and to cool slowly in air practically to eliminate all contraction stresses.

The theoretical considerations having been dealt with, the practical aspect will now be discussed. First, the preparation and welding procedure must be decided. The casting must be prepared for welding by chipping, drilling, grinding, or otherwise opening the defective part so that it is completely accessible to the welding electrode. Where the defect is a crack, it must be opened by "veeing," that is, cutting a vee-shaped groove along the course of the crack to within $\frac{1}{8}$ in. of the bottom. In the case of a blowhole, drilling or chipping may be employed to open the defect so that all sand and carbonised metal may be removed, and every part made accessable to the electrode. Preheating is the next operation, and the method will have been decided when considering the possibility of welding. Total preheating, though the safest and the completely "fool-proof" method of preparing for welding, is avoided whenever possible, as it increases the cost of repair, and when large castings are concerned, radiates so much heat as to make the welding a very uncomfort-

able job for the operator, with the increased risk of scamped work. Local preheating about the weld, as pointed out before, may be used when the weld is free to contract. There is a third group of cases which may be successfully welded by partial preheating. If it is judged that the contraction stresses will be confined to one or two places, it will only be necessary to preheat at those points of stress to eliminate all danger of fracture during cooling. The application of partial preheating, to cases where the stresses set up are only local, saves considerable time and money and often makes welding possible on large castings which it would be impracticable to preheat. It is not possible to give any hard and fast rules governing partial preheating, and experience alone will give the ability to judge the position of contraction stresses.

The actual preheating is simple enough. If total preheating is to be used, the whole casting is raised from the ground and bricked in with *firebricks*, the top row being slightly higher than the top of the casting. The casting is so arranged that the portion to be welded is at the top and as accessible as possible. A loose cover of asbestos millboard should be used to cover the whole completely. The most convenient form of heating is a coal gas or paraffin blow pipe. A hole should be left in the brickwork for the insertion of the blow pipe nozzle. If the casting is small or hollow, a single blow pipe will suffice, the flame in the latter case being directed inside. Otherwise a sufficient number of blow pipes should be used to obtain *uniform* heating of the work. Alternatively, coke or charcoal may be used for heating purposes, but such solid fuel is dirty, gives off dangerous fumes, and is generally inconvenient.

If partial or local preheating is employed, each part to be preheated is built in by fire-bricks, leaving spaces for the insertion of the blow pipe or air-blast nozzles if solid fuel is used. The general rules already given regarding preheating hold good in the above cases.

When the casting is at a red temperature, the amount of heat supplied is reduced considerably, but the casting is not allowed to drop below a dull red temperature during the welding. The cover, or a portion of the cover, is removed and welding commenced. There are a number of electrodes on the market for *depositing* cast iron, but the most satisfactory results are obtained by using any ordinary high-silicon (3 to 5 per cent.) cast-iron rod as used for oxy-acetylene welding. A flux is not used in this case. A moderately high current is used, varying according to the thickness of the work. The electrode is deposited in the usual way, and the welding is made as continuous as possible to conserve heat. When the weld is completed, the cover is replaced, the heating flames removed (or the fire allowed to die out), and the casting allowed to cool normally. The weld is a soft, fine-grain grey iron, and is readily finished by filing or machining.

The Mild-Steel Electrode Method.

It is often undesirable, or even impracticable, to preheat castings—even partially—and so the work has to be welded cold. This calls for considerable skill, both in deciding the best procedure and in completing the actual weld. The reason for this will be apparent from what has already been said regarding the extremely brittle nature of cast iron. Each globule of metal is chilled by the cold casting as it is deposited from the electrode, and the contraction in the weld is sudden, leaving a residual stress in the metal, which readily results in fracture in or near the weld. The sudden chilling also causes hardness of the deposited metal. The simpler cases where the weld is free to contract will not be considered here; in fact, they are generally welded with a cast-iron electrode. All other cases are considered very carefully beforehand to decide the best method of welding procedure to avoid fracture due to contraction. Local contraction in the weld cannot be prevented, because it is an inherent effect, and preheating is not employed to make it uniform throughout the casting. Therefore, the endeavour is always to prevent the contraction stresses resulting in *fracture*. As pointed out previously, if local contraction takes place in a ductile metal, it will stretch without fracture. This fact is made use of in the welding of cast iron, and the mild steel electrode is employed to utilise this effect. When a mild steel electrode is fused with cast iron, a considerable amount of the carbon present passes into solution in the deposited metal. The result is a kind of carbon steel which is always more or less blown, due to carbon monoxide being given off and trapped during the solidification. A second layer of metal deposited on the first will contain very much less carbon, because a part of the carbon that the first layer contains will be uniformly re-distributed throughout the re-fused portion of the first and the whole of the second layer. In this way each succeeding layer will contain less carbon than its predecessor. The third or fourth layers are for all practical purposes mild steel. The surfaces of the parts to be welded are "coated" carefully with three or four layers of mild steel before any attempt is made to weld them together. Then the parts are welded together, and the deposited metal remaining a mild steel, stretches without fracture under the force of contraction. Such welding procedure necessitates special preparation of the defect beforehand. Cracks are veed out with a space of an inch between the edges to allow three or four layers to be built up along both sides of the vee without meeting in the centre. Cracks which only extend part-way into the casting are drilled at the end to prevent spreading. Blowholes are opened up in the usual way.

Welding is commenced at any point, using only sufficient current to obtain fusion of the electrode with the cast iron. Each run is short, not more than 2 in. in length, to prevent contraction in the weld metal causing local fracture at the fusion line with the cast iron. After making two or three runs, welding is commenced at another point further along the crack, and this method of progression continued, returning to the starting point eventually and repeating the cycle of welds until the sides of the vee are covered with one layer of weld metal. The second layer is then commenced. The casting is never allowed to reach a temperature above 50 deg. C. Even using the method of alternative positions, it is necessary to allow the casting to cool periodically before proceeding with the welding. The welding is carried on in the same way until the third or fourth layer has been deposited, when the edges of the vee are nearly touching; then the two sides of the crack may be fused together by welding down the centre, in alternative position as before. The deposited metal is stronger than the cast iron, but the absorption of carbon from the cast iron which has been fused with the electrode causes a line of weakness, along which fracture will take place if excessive stress is subsequently put on the casting. Although the general mechanical properties of this zone are inferior to those of the cast iron, such a weld will serve very satisfactorily for the majority of cases. Though the case of a crack was instanced above, the principle is the same for a blow-hole.

If the casting is part of a machine subject to considerable working stresses, such as a press frame, it is desirable to obviate the weak zone caused by absorption of the carbon. This end is accomplished by the use of studs. The break is prepared by veeing as before—though the gap between the edges of the vee is unnecessary—and the sides of the vee are drilled and tapped for steel studs. The size of the studs varies from $\frac{3}{8}$ in. to $\frac{5}{8}$ in., according to the thickness of the casting, and they are placed at intervals. After the studs have been screwed into the holes, welding is commenced by making a single run round each stud, fusing the stud and the cast iron. Welding round each stud in successively larger circles is carried on until the circles meet and the gaps between are filled. Further layers are built on top until the vee has been completely welded. Any stress that may arise due to contraction of the weld, or subsequent working conditions, is chiefly transferred through the studs to the cast iron right outside the welded area, which consequently has been unaffected in its physical properties by the welding. The weld, and

the area around the weld, is stronger than the cast iron itself, and so gives the full service which may be required of it.

The choice of the most suitable of the described methods of welding for a particular case is decided primarily according to whether the casting belongs to the class in which the weld is free to contract, or the rigid type. If the former, either the cast iron or the mild steel electrode may be used without having to do more than locally preheat in the former case or take any of the special precautions in the second. Great care is necessary, however, if the casting belongs to the "rigid" class. If small, the casting is preheated and difficulties due to contraction are eliminated, combined with the advantage of a grey cast-iron weld. When the casting is large, it may be impracticable to preheat, or uneconomical. It may be possible to overcome contraction stresses, however, by partial preheating at the areas where the stress will be set up. Then either the cast iron or the mild steel electrode may be used according to the kind of weld metal desired. Should the casting be complicated, and any of the foregoing methods impossible, one resorts to the mild-steel electrode method, employing the gap between the edges of the vee as described. If done carefully, welding by this method is invariably successful. As a special precaution, studs may be used as explained.

By the judicious use of one or other of these methods, and by close observation of the effects, much skill has been gained in the successful repair of all classes of the most complicated castings. Long service under conditions of high working stresses has proved that the application of the process of arc welding to such repairs is not only fully justified, but saves a very considerable amount of money in replacements. The time saved in obtaining and refitting replacement parts is often of greater consideration. Now that systematic research work has established the process on a scientific basis, and it is becoming thoroughly known, engineers generally will accept welding without doubts as to its reliability. Then the process will come into well-merited prominence.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature. Liquidations and Failures.

Information for Shareholders.—WHITEHALL ELECTRIC INVESTMENTS, LTD., has issued a handsome brochure with the object of giving information to its share and debenture holders as to the various electrical undertakings in which the company's capital has been invested. The publication is profusely illustrated with views of the power stations, &c., in South America operated by the company's Latin-American subsidiaries. Particulars are given of the improvements which have recently been carried out, and the capacity and output of the supply undertakings. The latter have a total capacity of 122,000 kW, and the output in 1925 approached 300 million kWh.

Wiring Old Houses.—During the last decade or so the Northern States Power Co. has carried on a "campaign" for the wiring of old houses in Minneapolis. The result has been to bring the number to near "saturation point." In this city of between three and four hundred thousand inhabitants there were 52,000 unwired houses in 1914; by the end of 1924 only 6,000 remained unwired, and the campaign is being continued. The *Electrical World* says that the effect of the company's efforts is seen in the decreasing proportion of old houses wired in the number of new lighting customers. In 1923 the old houses wired accounted for 63 per cent. of the total, whereas in 1924 only 47 per cent. of new lighting customers were represented by old houses wired.

A Great Charitable Effort.—During the year which has just ended the employés of Messrs. A. Reyrolle & Co., Ltd., subscribed over £1,130 for hospitals and charities. The Employés' Hospital and Charities Committee has allocated this amount to 21 institutions and funds. The Newcastle Royal Victoria Infirmary and the Hebburn Infirmary receive £325 each and £100 is allotted to the Employés' Benevolent Fund.

Tyneside Developments.—On January 5th, Mr. H. W. Clothier presided at a meeting of the Electrical Section of Newcastle Chamber of Commerce when it was decided to strengthen the committee in view of the developments which may take place as a result of the effort being made to attract new industries. It is intended to obtain information as to the general costs of starting works on Tyneside, as compared with the costs experienced in other districts.

British Rails for British Railways.—The London and North-Eastern Railway has announced that in future it intends to specify that all rails supplied to it must not only be of Britis.. manufactured steel but must also be made from steel of British manufacture throughout. The other railway groups state that they already make this proviso in their contracts, the Southern Railway, indeed, insisting upon British goods for all its contracts.

British steel rails have made good showing in Japan. According to a recent statement by Sir William Larke, director of the National Federation of Iron and Steel Manufacturers, an investigation into the history of rails which had been in service for 54 years proved that after 40 years of service British rails showed no signs of breakage. Although American, Belgian, German, Russian and Japanese rails had lives of from 10 to 40 years, only a small quantity reached the latter figure.

"Underfeed" Contracts.—Among the more important orders recently received by the Underfeed Stoker Co., Ltd., for power station equipment are the following:—London Electric Supply Corporation, Ltd., air heaters and two Detrick arches; Nottingham Corporation (North Wilford station) six self-contained stokers; Central Electric Supply Co., two Detrick arches and four self-contained stokers; and Poplar Borough Council, ash and coal conveying plant.

Swiss Water Power Exhibition.—An International Exhibition of Inland Water Transport and the Utilisation of Hydraulic Power is to be held at Basle from July 1st to September 15th. During the period of the exhibition (from August 31st to September 12th) the first sectional meeting of the World Power Conference will be held in the city.

The Home Market.—Speaking at a recent luncheon at Nottingham, Sir Philip Cunliffe-Lister, President of the Board of Trade, said that the home market had of recent years assumed greater importance. It was our greatest market, and the more it could be developed the better our trade balance would be, providing more money for new markets abroad. Sir Philip said that the growing recognition of the value of Imperial trading relations was a hopeful sign for the future.

Electrical Trades Commercial Travellers' Association.—The social evening arranged for Friday, January 15th, has been postponed until Friday, the 22nd.

British Enterprise in South America.—In the course of a note on the British Industries Fair, the *Review of the River Plate* says:—"The publicity which has been given in Argentina to the forthcoming exhibition is a most excellent sign. It shows that manufacturers at home are acting in a fuller consciousness of their responsibilities to their emissaries in this part of the world and that merchants and representatives here will be able, in the future, to count upon the practical help and support they need, but which has not always been theirs in the past. This awakening of British manufacturers and traders to a sense of what is needed of them in the way of livelier enterprise and more wide-awake initiative is progressing satisfactorily. Numerous publications in the Spanish language giving valuable information regarding British industrial aims and developments show that Britain is waking up in many ways. Once the awakening process has been completed, we may be sure that the resultant and welcome trade push will be such as will take all minor obstacles in its stride."

A Holophane Staff Conference.—A half-yearly conference of the indoor and outdoor staff of Holophane, Ltd., was held on December 29th and 30th. In addition to the various matters discussed by the staff, the conference had the benefit of hearing interesting and instructive papers read by gentlemen prominent in the illuminating engineering movement who are not connected with the firm. Amongst these were Mr. Leon Gaster (secretary of the Illuminating Engineering Society) who gave a review of illuminating engineering progress during 1925; Mr. L. L. Robinson (Borough Electrical Engineer of Hackney), who dealt with "Street Lighting"; Mr. W. E. Bush (of E.L.M.A.) on "The Policy of E.L.M.A. Lighting Service Bureau"; Mr. W. J. Jones (of E.L.M.A.) on "Shop Window Lighting"; and Mr. Dudley Digges (of the Street Lighting Department, International General Electric Co., of Schenectady, U.S.A.) on "Some International Aspects of Street Lighting."

Belgian Import Regulations.—The *Board of Trade Journal* for January 7th contains a list of goods for which certificates of origin are required upon importation into Belgium. The list includes tubes and pipes of iron, steel or cast iron; cable-making machinery, complete; dynamo-electric machines; electric accumulators and plates; submarine and land cables; electric and electrotechnical apparatus and parts; articles for electrical purposes of porcelain, faience, terra-cotta, stoneware or glass with metal parts; and insulating parts of asbestos, mica, micanite, rubber, ebonite, and other materials.

Local Exhibition.—MOTHERWELL.—At a recent exhibition of electrical cooking appliances the Credenda Conduit Co., Birmingham, displayed the "Creda" cooker, with which demonstrations were given by Mrs. Mole, M.C.A. (gold medallist). Other exhibits were made by the General Electric Co., Ltd., and Carron Co., while the tea-room lights were by the British Thomson-Houston Co., Ltd. An exhibit of model lighting was given by the Glasgow Lighting Service Bureau. In the radio section the General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd., were represented. Lady Belhaven, president of the Scottish Electrical Association of Women, visited the exhibition, and spoke of the great saving effected by electric cookers and fires.

Meter Approved. — The Electricity Commissioners have approved of the construction, pattern, and method of fixing the meter known as the Chamberlain & Hookham single-phase watt-hour meter, Type "A1," rated from and including 5 amps to 20 amps., 200 V, at a frequency of 50 cycles.

An English Offer to Costa Rica.—*Commerce Reports* states that an English manufacturer of hydro-electric equipment has offered to install all the necessary plant for the recently-formed Cia. Nacional Hidro-electrica, Costa Rica, for about $375,000, the payments to be made over a period of five years following the installation and operation of the plant.

On the Ability to Sell Goods.—An address entitled "Notes on Salesmanship" was delivered to the Junior Institution of Engineers on Friday last by Mr. A. J. Simpson, the chairman. He summarised the qualities required in a salesman or representative as optimism, patience, tact, individuality, judgment of human nature, knowledge of things in general, and method, and he then described the nature of the work that a salesman had to do and the parts all those qualities played in it. Mr. Simpson invited discussion of his remarks, and a large number of members expressed their views. Mr. J. S. Highfield, who presided, said that he agreed with Mr. Simpson that it was generally desirable that salesmen should know how the articles they were selling were made; there were sometimes objections, and he gave examples of when it was desirable and when otherwise. Messrs. Rentell, A. E. Knight, and E. North spoke about means for securing the interest of buyers. Mr. F. E. Murrell said that he was now in England for the purpose of arranging a contract because representatives abroad had not sufficient technical knowledge to deal with the contemplated order. In distant lands a knowledge of things in general was very important indeed; an agent who could retail the latest information would never have his name forgotten. Mr. H. R. Williams and many other members contributed to the discussion. Some of their points may have seemed to be only small ones, but they were useful for intending or persevering salesmen.

Employés' Representative on J.E.A.—The Minister of Labour announces that he will shortly notify the Electricity Commissioners of the employés' organisations having members in the employment of the authorised undertakings composing the West Midlands Electricity District in order that these organisations may choose a representative. The unions concerned must make application to the Minister of Labour, on a special form, by January 23rd.

Trade Announcements. — MESSRS. BURWOOD (CONCESSIONAIRES) LTD., of 41, Great Queen Street, Kingsway, London, W.C.2, wish the trade to know that their letter-box was broken open on the morning of January 5th and all correspondence stolen. They would appreciate copies of letters due for delivery on that morning.

MR. J. H. GREENWOOD, of 21, Weston Lane, Otley, Yorkshire, asks for copies of trade circulars and catalogues for the use of students.

MESSRS. SIDNEY G. JONES, LTD., of Victoria Street, S.W., have removed to 1-3, Brixton Road, Kennington, London, S.W.9.

MESSRS. J. & E. HALL, LTD., of Dartford, have acquired a controlling interest in Medway's Safety Lift Co., Ltd., and are taking an active part in the management. The lifts will be manufactured at Dartford, where extended facilities are available, and special attention will be devoted to the maintenance department.

MESSRS. ALLEN-LIVERSIDGE, LTD., have just registered a company in Bombay under the name of Allen-Liversidge (India), Ltd., for the purpose of carrying on, in India, their business of dissolved acetylene manufacturers, carbide merchants, and lighting and heating engineers.

MESSRS. TAYLOR & PETTERS, LTD., mica merchants, have removed from Hatton Garden to 3-11, Westmoreland Place, City Road, London, N.1. New 'phone number:—"Clerkenwell 4105."

MR. GEORGE E. WHITEHEAD, who for some years has represented Messrs. Ferguson, Pailin & Co., Ltd., and the Lancashire Dynamo & Motor Co., in South Wales and the Western Counties, has severed his connection with these companies and has commenced on his own account at 102, St. Mary Street, Cardiff, as engineers' agent, having secured agencies for Messrs. Erskine Heap & Co., Ltd., and Edison Accumulators, Ltd.

THE MANCHESTER DISTRICT WIRELESS CO., of 21, Agur Street, Bury, Lancs., whose premises were damaged by fire on January 5th, has secured temporary accommodation at 14, Union Street.

Catalogues and Lists.—MESSRS. P. L. DWYER & Co., 30, Grosvenor Place, S.W.1.—January price list of electrical materials and accessories.

MESSRS. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, W.C.2.—An illustrated pamphlet for the trade announcing details of the "Universal" electric cleaner, electric ironer, washing machine, and other domestic appliances.

THE ATHOL ENGINEERING CO., Cornet Street, Higher Broughton, Manchester.—An illustrated pamphlet advertising a number of radio components—coil holders, earthing plugs, valve holders, &c.

BRITISH INSULATED CABLES, LTD., Prescot, Lancashire.—A well-produced catalogue of mining cables and accessories, containing particulars and illustrations of v.b., paper, and v.i.r. cables, joint boxes, cable racks, cable winches, switch-fuses, insulators, compounds, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A mailing card drawing attention to the company's radio sets, valves, wall plugs, and lampholders. Also Leaflet F.3,974, containing illustrations and prices of "Gecoray" shop-window lighting reflectors.

THE DE LAVAL CHADBURN CO., LTD., Wellington House, Buckingham Gate, S.W.1.—A booklet entitled "The Purification of Insulating Oils," containing details of the construction and operation of the company's centrifugal machines, and notes on the determination of the dielectric strength of insulating oils.

THE WHOLESALE FITTINGS CO., LTD., 23, 25 & 27, Commercial Street, E.1.—A pamphlet, illustrated in colour, giving prices of "Silchrome" glass shades with burned-in designs.

MR. HENRY JOSEPH, 96, Victoria Street, S.W.1.—A pamphlet illustrating radio cabinets made by Messrs. W. & T. Lock, Bath. Fully priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—Illustrated and priced booklets dealing, respectively, with display lighting equipment and domestic electrical appliances. Also a leaflet advertising "Memrex" ironclad switchgear.

MESSRS. J. & W. B. SMITH, LTD., 15-23, Farringdon Road, E.C.1.—An illustrated price list of "Redot" electric fires and domestic appliances; a booklet dealing with electric lighting for the home; and a pocket price list of electrical accessories.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—A folder containing prices of two- and three-phase protected squirrel-cage motors up to 16 h.p., and air-break starters.

Bankruptcy Proceedings.—W. A. A. C. ROBINSON, electrical engineer, 10, Carnaby Street, Golden Square, W.C.—Bankrupt's discharge suspended for two years until November 24th, 1927.

J. ADDY, lately wireless and cycle dealer, Bridge End, Long Preston.—Last day for proofs for dividend, January 19th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

A. H. MONCRIEFF, wireless manufacturer, late of 197, Anerley Road, S.E.20, and 60, Thornton Road, Bradford.—Last day for proofs for dividend January 19th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

T. A. WICKHAM, electrical engineer, Snaresbrook, Station Road, New Milton, Southampton.—Last day for proofs for dividend, January 20th. Trustee, Mr. H. Ashton, Official Receiver, Bank Chambers, High Street, Southampton.

A. F. WEBB, electrician, 102, Duke Street, St. Helens, Lancs.—Receiving order made January 6th on debtor's own petition.

A. C. STUART and C. PERRIER (Stuart Wireless Telephone Co.), 109, Kingsway, W.C.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released December 31st.

M. D. ROSENBLOOM (D. Rose & Co.), electrical engineer, 25, Osborn Street, E.—First and final dividend of 1s. 1d. in the £ payable January 20th at Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C.

JOHN BRODIE, electrical engineer, 59, High Street, Dunfermline.—This debtor was examined on January 7th. He admitted liabilities of £456, with assets amounting to £231, and said that he started business with a capital of £60. He attributed his bankruptcy to the loss of over £200 on a large contract.

Company Liquidations.—HOLOPHANE, LTD.—Winding up voluntarily for reconstruction purposes. (See ELEC. REV., January 1st, p. 15.) Liquidator, Mr. J. W. Ife, 122, Manor Waye, Uxbridge, who is authorised to consent to the registration of a new company to be named Holophane, Ltd. Meeting of creditors at Elverton Street, Vincent Square, S.W., January 15th. (This notice is purely formal, as all creditors have been or will be paid in full.)

CLEVELAND ELECTRICAL ENGINEERING CO.—Particulars of claims to Mr. M. McGilligan, 29, Grange Road, Middlesbrough, liquidator, by January 26th.

SOUTH-EASTERN AND CHATHAM CONSTRUCTION AND POWER CO., LTD.—A meeting of members is called for February 10th at the offices of the Southern Railway Co., Waterloo Station, to hear an account of the winding up from the liquidator, Mr. R. D. Heckels.

RE-ECHO ELECTRICAL MANUFACTURING CO., LTD.—Liquidator, Mr. G. D. Pepys, Official Receiver and Liquidator, Carey Street, released January 6th.

American Boiler Company's Purchases.—The *Financial Times* reports that the Babcock & Wilcox Co., of America, has purchased the Fuller-Lehigh Company and its subsidiaries, manufacturers of pulverised fuel and cement mill equipment; also the Bailey Meter Company, manufacturers of meters and recorders, combustion-control equipment, pulverised fuel plant, and water-cooled furnace walls.

Charge of Obtaining Goods by False Pretences.—At Old Street Police Court, on Tuesday, Charles Fredk. Kidby, 29, gramophone dealer, of 4, Roslyn House, Rushcroft Road, Brixton, and Alfred Sidney Taylor, 42, engineer's fitter, of 77, Carysfort Road, Stoke Newington, were charged on remand from January 4th with being concerned together in knowingly obtaining by false pretences a quantity of wireless goods, value £44 8s. 4d., from Ernest Edward Rooke, with intent to cheat and defraud, at City Road, E.C. Mr. Clayton prosecuted for the Director of Public Prosecutions, and, in opening the case, said that there would be further charges of obtaining goods by false pretences and also charges of conspiring to defraud. The two men had been trading as a company, C. F. Kidby, Ltd., from January, 1924. Premises were taken in City Road, and according to their bill heading they were wireless set manufacturers, cycle and gramophone manufacturers and importers, and apart from that they seemed to have dabbled in all sorts of things. There was no doubt about it that before the formation of the company the business seemed to have been paying its way, but it was suggested by the prosecution that from October, 1924, to June, 1925, the business was nothing but a fraudulent one. So far there were 110 complaints, and the total amount was about £3,000 in varying sums.

Mr. James Crewys, director of the Power Equipment Co., electrical engineers, Hendon, said that on December 9th, 1924, he received a letter from Kidby, Ltd., signed "A. Taylor, director." They replied and sent on a sample transformer. On December 18th a letter was received acknowledging receipt and enclosing an order for 50 transformers, the approximate value being £20. On January 7th they received another order for 50 transformers, value £22 18s. 6d. They had not been paid in respect of those orders.

Mr. Ernest Edward Rocke, proprietor of Rooke Brothers, wireless component manufacturers, W.C.1, said that on January 17th they received an order for wireless components, value £20 11s., and on February 3rd a similar order to the value of £23 8s. They had not been paid.

A further remand was ordered, defendants being admitted to bail in one surety in £250 each.

Copper Prices.—Messrs. F. Smith & Co. report January 12th:—No change in the prices of electrolytic copper.

Messrs. James & Shakespeare report January 12th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £36 10s., 10s. decrease.

Messrs. Edward Till & Co. report January 12th:—India-rubber, Para fine, 3s. 6d., 4d. decrease.

Dissolution of Partnership.—MARLEY & WHITE, radio engineers, agents and merchants, 17, Sand Hill, Newcastle-on-Tyne.

Receivers Appointed.—COLE, MARCHENT & MORLEY, LTD., Bradford.—On behalf of the debenture-holders Mr. Alfred Greaves (F. H. Lee & Greaves, chartered accountants, 35, Bank Street, Bradford) and Mr. R. S. Brailsford have been appointed joint receivers. The announcement was made public on January 6th. The object of the appointment, it is stated to inquirers, is primarily for protection of the debenture-holders, but it is also hoped that it will enable the business to be continued as a going concern and without stoppage, whilst meanwhile it is hoped to find a solution of the difficulties arising out of the long period of bad trade during the past several years' slump. The business of Cole, Marchent and Morley, Ltd., has been established about 70 years, and employs normally between 300 and 400 workpeople. Our Bradford correspondent writes:—"At present the undertaking is fairly busy and the report on the past year's trading was one of the most bright in the rather doleful reports generally of engineering conditions in Bradford during 1925. During the past year orders completed by the company included a large twin condensing plant for the recently-inaugurated 20,000-kW turbo-generator at the Valley Road station of the Bradford Corporation Electricity Department and a somewhat similar order for the Leeds Corporation. The concern has nearing completion an order for two condensing plants for 15,000-kW turbo-generators for an electrical power station in the Midlands, and during the year it has been engaged on, or is still working on, condensing plants for Cardiff, Swansea, and Oxford."

Calendars, Diaries, &c.—A literary calendar has been received from BULL MOTORS, LTD., Ipswich. This has a block of slips with a quotation from Shakespeare for every day.

A neat calendar has been issued by the SOLENOID REGULATOR Co., 268, Moseley Road, Birmingham, consisting of a purple and gold case containing monthly date cards.

From MESSRS. W. W. SPRAGUE & CO., LTD., lithographers, of Bread Street Hill, Queen Victoria Street, London, we have received copies of their wall calendar, and blotting pads with memoranda slips, calendar, &c.

The D.P. BATTERY CO., LTD., of Bakewell, Derbyshire, once again dispels our London gloom with a beautiful piece of local scenery ("The Valley of the Dove, near Crowdicotes, Derbyshire") on its wall calendar for 1926.

MESSRS. HENRY WIGGIN & CO., LTD., Victoria Station House, Victoria Street, London, S.W., have sent us an excellent vest pocket diary which is unquestionably "one of the best."

MESSRS. W. G. BEAUMONT & SON, painters and contractors, of Priory Works, Bow, E.3, have sent us a copy of their annual year book and desk diary, and a calendar with a humorous picture by Lawson Wood.

Lead.—Reporting on January 9th, Messrs. James Forster and Co. stated:—"There is still little active buying by consumers, and it is really remarkable under these circumstances that the price has held up so well in view of the recent heavy arrivals. With these out of the way and a revival in demand from the trade, we might quite see a further recovery in values."

Social Events.—The second annual carnival of the A.T.M. Sports and Social Club (Automatic Telephone Mfg. Co., Ltd.) was held on December 29th, at the Grafton Rooms, Liverpool. It proved a very successful event, about 800

Prizewinners at an A.T.M. Carnival.

attending, and many original and attractive costumes were in evidence. We reproduce herewith a photograph of the prize-winners.

The annual staff dance and whist drive of the Clydesdale Supply Co., Ltd., Glasgow, was held on January 5th. Mr. A. Levine, managing director, and a representative gathering attended.

The annual staff dinner of Messrs. Francis Polden & Co., Ltd., took place on January 9th, at Anderton's Hotel, Fleet Street. The chairman (Mr. E. C. Polden) presided, and was supported by Mrs. Polden and a number of guests. Mr. F. J. Baker, in proposing the toast of "The Chairman and Company," expressed the appreciation of the staff of the efforts of the company. Mr. Polden replied, and later proposed the toast of "The Staff," and thanked them for their endeavours to maintain the work at a high standard. A musical programme was given by "The Merry Dominoes."

On January 2nd, the Sales Department of Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.), held its second annual companionship dinner and dance at the Connaught Rooms. About 120 people were present, including representatives of the engineering, manufacturing, and other departments. Mr. H. C. Trenain, general sales manager, presided, and a thoroughly enjoyable and successful evening was spent.

Brazilian Concessions to Rubber Factories.—In an effort to encourage the establishment of rubber factories in Brazil, the Government is offering special privileges to manufacturers. Among the concessions to factories for the manufacture of rubber articles which may be established in Brazil during the next three years, and those already established which increase their plants during the same period, is exemption from import duties and bureau charges during a period of 25 years for machinery, tools, and material necessary for the installation and extension of the factories or plants, chemical substances, various textile materials, combustibles and lubricants, indispensable to the working of the factories or plants. The exemption conceded on machinery, utensils and tools is retroactive, being applicable to such articles imported after January 5th, 1921.—*Reuter's Trade Service* (Washington).

The Shannon Scheme Dispute.—While the wages dispute in connection with the Shannon hydro-electric scheme cannot be said to have reached a definite settlement, the contractors, Messrs. Siemens-Schuckert, Ltd., have offered unskilled workers an advance in the rate from 32s. to 35s. 6d. per week, and more men are now being employed, with the result that a considerable amount of work is proceeding. The general feeling is that the strike will collapse. There is a marked increase in the opposition to the Labour Party's attempt to boycott the work by withholding labour.

German Radio Exhibition.—Under the auspices of the German Messe Amt and the German Association of Radio Dealers, a radio exhibition is to be held in Deutz-Cologne from January 30th to February 7th next. It is stated, however, that the Central Association of German Electrical Firms and the Union of German Radio Manufacturers have decided that the present financial position of the industry in particular, and Germany in general, is such as to render official recognition of the exhibition undesirable. The members of the two bodies have consequently been notified that they must not take part in the display.

For Sale.—The Director of Army Contracts invites offers for one 150-kW rotary converter, with starter and starting and distribution panels. Blackpool Corporation Electricity Department has for disposal one Browett, Lindley triple-expansion type engine, coupled to a British Westinghouse generator. Mr. H. J. Shaw will sell by auction on January 20th, at 13, High Holborn, W.C., the stock of an electrical and wireless goods factor and the stock of an electrical motor lamp and cable manufacturer. Bexhill Corporation Electricity Committee has for disposal two 500-kW Belliss-Dick, Kerr and Westinghouse d.c. generating sets, with field rheostats and circuit-breaker panels. Edinburgh Corporation Electricity Supply Department invites offers for two B. & W. boilers, with chain stokers and economisers, three Lancashire boilers, and two 330-kW Howden-Crompton 460-V, d.c. generating sets. Wembley Amusements, Ltd., invite offers for surplus electrical equipment. (See our advertisement pages to-day.)

The New Zealand Electric Federation.—Our New Zealand correspondent says that electrical utility services in New Zealand have grown to such a degree of popularity that the recently-formed Electric Federation is considered to be a move in the right direction, calculated to restore public confidence in the conduct of the trade generally, a confidence which showed a tendency to waver as the result of many anomalies which previously existed. As a first move the Federation sent its president overseas to study electrical matters in Canada and the United States, and as a result of the data thus obtained it is intended to develop the Federation's policy in New Zealand. New Zealand electrical houses have much to learn from America in the matter of merchandising electrical goods, as well as with regard to methods for popularising electrical utilities, but before definite selling and advertising campaigns are undertaken, it will be necessary to put New Zealand's house in order in other directions. The Federation is alive to this necessity, and is now concentrating upon the standardisation of materials and the securing of uniformity in the regulations governing electrical installations. At the present time some conflict of methods exists among the various Power Boards and others interested in distribution, and the Government is bringing in a measure to secure the licensing of all wiremen. The Government, as previously reported, is also considering the matter of establishing an Electric Standards Board with a view to testing and standardising all electrical material coming into the country. A conference of the Power Boards the Government, the traders, and the Federation is being held shortly, when some matters of importance will be discussed.

Burnley and the Sale of Appliances.—At a recent meeting of the Burnley Town Council, Alderman Nuttall moved the reference back of minutes dealing with the sale of electrical appliances for cash or hire purchase. Councillor Parkinson inquired whether at the proposed electrical exhibition the Corporation would sell appliances at prices lower than those of private contractors, and whether it was wise to charge for admission to the exhibition. Alderman Nuttall replied that appliances sold by the Corporation would bear the same price as those of contractors in the town. It was necessary to have some charge for admission, but ten thousand free tickets would be issued to suitable people. Councillor Proctor said that if the Corporation could sell appliances cheaper than private firms it ought to be proud of doing so, and it would be to the advantage of the public. Councillor Whittaker asked if the price charged by the Corporation would include distribution, cost of fixing, &c. Alderman Nuttall said he was not sure that it was in the best interests to answer these questions. Their policy would be to sell at the same price as contractors, both at the exhibition and afterwards.

A Report upon North Africa.—A composite report upon the economic and commercial conditions in North Africa has been issued by the Department of Overseas Trade (Stationery Office, 3s. net). The principal feature of this is that it shows the predominance of French influence, and in the case of Cyrenaica, of Italian interests. Among the matters touched upon in the report is the electrification of the normal-gauge railway system in Morocco. The bulk of the material for this is being received from France. The line from Casablanca to Fez is the first line being electrified. The power station in the former place was completed at the end of 1924, and in May, 1925, it was linked up with a transformer station to supply Rabat and Salé. An automatic telephone exchange is approaching completion at Rabat. From a list of imports during 1924 it is seen that, of a total value of 1,149,000 fr. of dynamos imported, France was responsible for 1,145,000 fr. In the Tangier Zone there was a decrease in the quantity of machinery (unspecified) imported, but the French share was considerably greater. Interest in radio is being manifested in Algeria, but the use of British apparatus is generally precluded by the low exchange value of the franc. This factor also militates against the importation of other classes of British goods, although during 1923 British machinery to the value of 6,303,000 fr. was imported. In the section dealing with Tunisia, mention is made of the Cie. des Tramways de Tunis, which supplies electricity and runs an electric tramway and railway. In 1924 the company earned a gross profit of 1,208,077 fr. upon its capital of 12 million fr., paying a dividend of 6.5 per cent. net.

Explosion at Rubber Works.—An explosion occurred last Saturday in the power station of the Leyland and Birmingham Rubber Works. It is stated that damage to the extent of £6,000 was caused, the building being completely wrecked.

Book Notices.—"The *Mechanical World* Electrical Pocket Book, 1926." Pp. 401; figs. 130. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net.—As usual, this work treats the many phases of electrical engineering in a manner rendering it a useful book of reference to the practical engineer, wireman, &c. Several new features are to be found in this edition; an additional chapter deals with magnetic chucks and clutches, while a variety of new methods has been included in the chapter on jointing conductors. New material is furnished on electro-chemistry, and other new sections include industrial electric heating, cutting by the electric arc, and electric lifts, cranes, &c. The diary and memoranda for the year in question are included as usual.

"O'Connell's Coal and Iron Diary and Manual, 1926." (Pp. 508, diary and memoranda pages.) London: Harper and Co. Price 10s. 6d. (subscribers 5s.), post free.—In addition to being a useful general handbook and diary, this publication is a complete guide to the coal industry of Great Britain. The directory section contains exhaustive lists of collieries, coal owners, factors, and exporters, and the type of coal produced by British coal owners. The Coal Mines Act is reproduced, and so are the regulations governing the use of electricity in mines, the Explosives Act, 1875, and other legislative measures. The volume closes with a classified trades' directory in which electrical firms have a good showing.

"The Practical Electrician's Pocket Book, 1926." By H. T. Crewe, M.I.Mech.E. Pp. xci+585; illustrated. London: S. Rentell & Co., Ltd. Price 3s. net.—This is the 28th edition of this publication. It has been revised, and much of the matter dealing with elementary principles has been re-written. New chapters on power factor correction, fault localisation on underground cables, and automatic protective gear have been included in this edition, and the central station tables have been brought up to date.

"Electrical Photometry and Illumination," by H. Bohle. Second edition. Pp. xvi+427; figs. 320, and 59 tables. London: Chas. Griffin & Co., Ltd. Price 25s. net.

"Industrial Electricity." Part II. Pp. xv+480; illustrated. London: McGraw-Hill Publishing Co., Ltd. Price 13s. 9d.

"Engineering Abstracts from Current Periodical Literature." No. 25. October, 1925. London: Institution of Civil Engineers.

"The A B C of Relativity," by Bertrand Russell, F.R.S. Pp. 231. London: Kegan Paul, Trench, Trubner & Co., Ltd. Price 4s. 6d. net.

"The *Journal* of the Institute of Transport," No. 3, Vol. 7, January, 1926. Price to non-members, 2s. 6d.

"Miscellaneous Publications of the U.S.A. Bureau of Standards," No. 69.—Annual report of the director of the Bureau for the fiscal year ended June 30th, 1925.

"Scientific Papers of the Institute of Physical and Chemical Research, Tokyo, Japan." Vol. 1, Nos. 1-11, April, 1922, to March, 1924.

Foreign Machinery in Japan.—Japan's dependence upon foreign countries for her electrical equipment is illustrated by recent statistics showing the amount of plant installed in the country and the proportions of it made by foreign and Japanese firms respectively. For instance, the total capacity of installed water turbines is given as 1,143,800 h.p., and of this 960 800 h.p., or 84 per cent. has come from abroad. As regards other plant, Japanese manufacturers have only supplied 14 per cent. of the 450,250 kW of steam turbines installed; 17 per cent. of the hydro-electric generator capacity of 819,544 kW; 12 per cent. of the steam-driven generators (472,500 kW); and 20 per cent. of the transformers (3,033,680 kVA). Only 3 per cent. of the boiler capacity installed consists of Japanese plant, and this is all in private service.

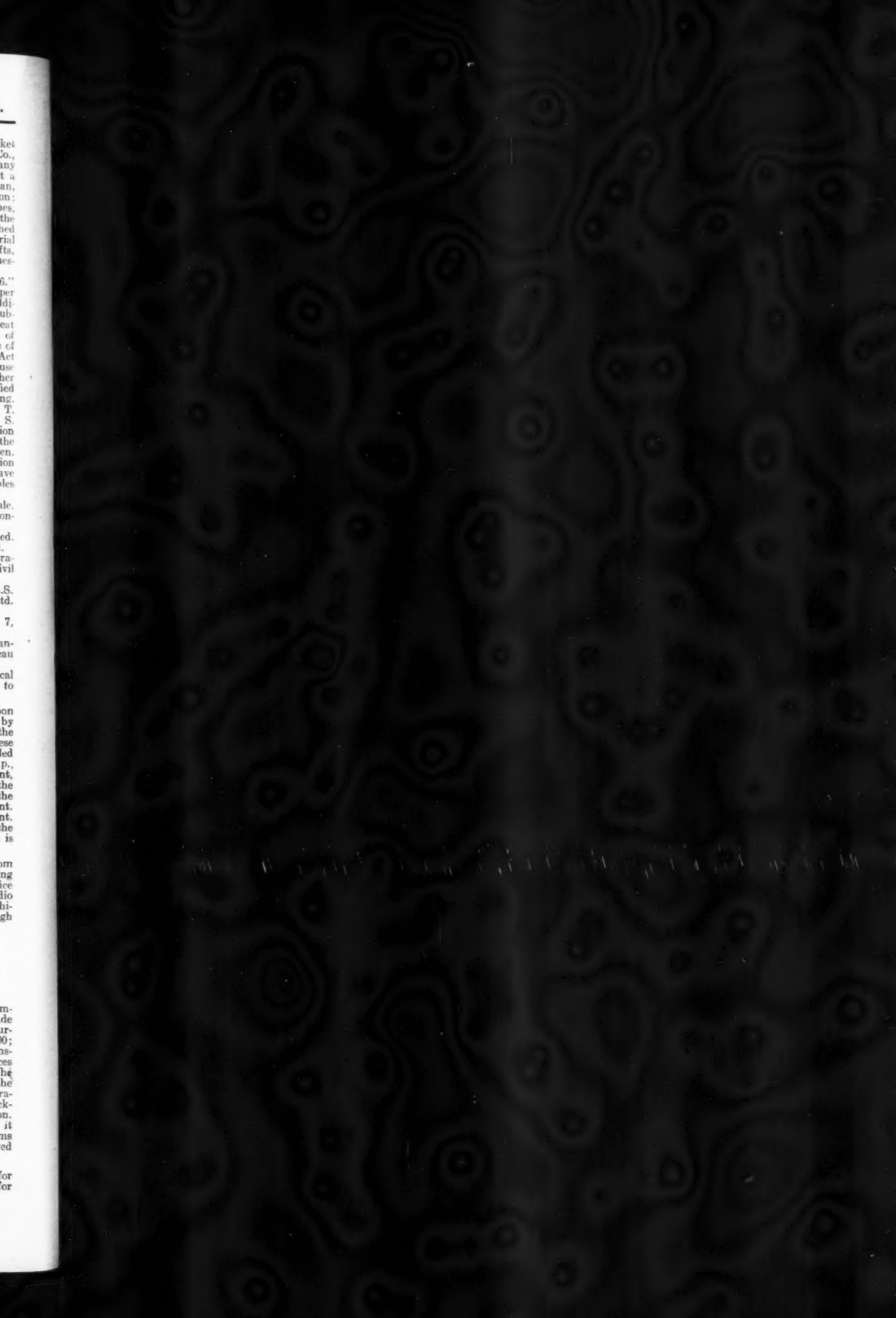
A Rumanian Radio Exhibition.—It is reported from Bucharest that the Rumanian postal authorities are organising a permanent exhibition of radio apparatus in the head office in that city with the object of encouraging interest in radio matters in Rumania. Any British firm interested in the exhibition would doubtless be able to obtain particulars through the British Consul in Bucharest.

Lighting and Power Notes.

Barrow.—LOAN.—The Corporation has approved the recommendation of the electrical engineer that application be made for sanction to the borrowing of £48,000 for electricity purposes, made up as follows:—E.h.p. transmission lines, £31,000; sub-station buildings, £2,500; sub-station switchgear and transformers, £8,000; h.p. and l.p. distributing mains and services (Dalton and Ulverston R.D.C.), £6,000; meters, £500. The General Purposes Committee has considered terms with the Backbarrow Charcoal Iron Company and the Lancashire Ultramarine Company for the use of the River Leven at Backbarrow for the purpose of a proposed hydro-electric station. An official report of this meeting has not been issued, but it is understood that the members were in favour of the terms submitted subject to the proposed agreements being approved by counsel.

Bolton.—LOAN.—The Electricity Committee is applying for sanction to the borrowing of £75,000 for mains extensions for the next three years.

(*Continued on page 103*)



Imperial Wireless "Beam" Communication.

Progress of the Canadian and South African Service Stations.

THE year 1926 bids fair to be one of the most important in the history of commercial wireless telegraphy as it affects Great Britain and the Empire. In a few months' time the first of the new Marconi-type "beam" stations will be brought into operation, and in the course of the year direct high-speed wireless services on the short-wave system will be established with all the principal Dominions. The first of the "beam" stations are in an advanced state of construction. All the masts have been erected, the buildings completed, and the machinery and some of the wireless apparatus installed. The main part of the wireless apparatus (the transmitters and receivers) is now being tested at the Marconi Co.'s works at Chelmsford, and it will be installed as soon as the tests are completed. Meanwhile, work is progressing on the erection of the aerial and feeder systems, and in fencing and roadmaking.

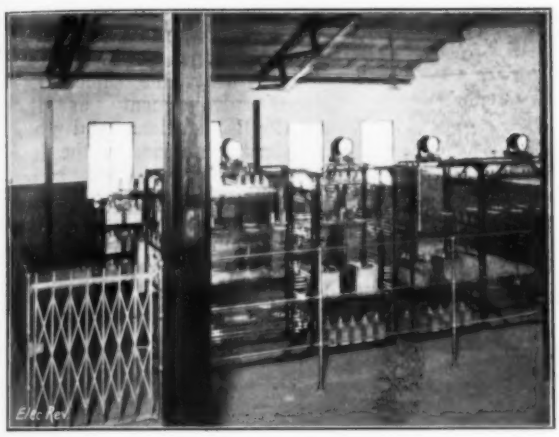


Fig. 1.—Bodmin Transmitting Station: Rectifying Panels.

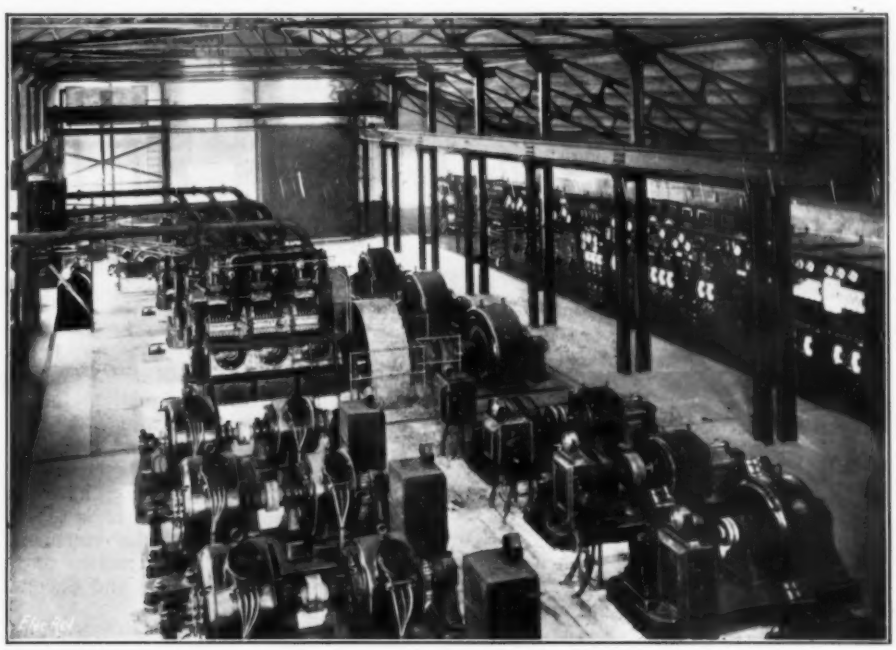


Fig. 2.—Bodmin Transmitting Station: Power Generating Plant and Switchboard.

The stations now nearing completion are at Bodmin in Cornwall, and at Bridgwater, in Somerset. The Bodmin transmitting station will be used for communication with Canada and South Africa, and the Bridgwater station will be the receiver for these services. At each station there are ten masts, five for communication with each Dominion, and their design is identical for the transmitting and receiving stations. The five masts for each Dominion are erected in a straight line at right angles to the direction in which communication is to be established; they are 277 ft. high, each having a cross arm at the top measuring 90 ft. from end to end. The aerial and reflector will consist of a number of vertical wires suspended from triatics attached to the cross arms of the masts. There will thus be two parallel steel cables, separated by a distance which depends on the wave-length used, running on each side of the masts from the first to the last. From these cables the vertical aerial and reflector wires will be suspended, the lower ends of the wires being kept in position by balance weights. The distance between the masts is 650 ft., from centre to centre, and the length of the whole system of five masts for each transmitter is about 3,200 ft. from tail anchor block to tail anchor block.

Fig. 3.—Bridgwater Receiving Station: Switchboards and Station Lighting and Battery Charging Plant.

At the Bodmin transmitting station the power plant consists of Ruston & Hornsby cold-starting oil engines driving d.c. generators built by Messrs. Newtons, of Taunton. The various voltages required for the operation of the valves will be supplied by motor generators and alternators. The valves themselves will be of the oil-cooled type, and the complete valve transmitters will be housed in a separate room adjacent to the power house. The generating plant has been mounted on a concrete raft, supported on cork to prevent vibration reaching the transmitting set, and the valve oscillators themselves are mounted on a similar raft. From the transmitting room feeders are led to the aerials by

means of copper tubes fixed above the ground. At the Bridgwater receiving station power is supplied by 18-h.p. two-cylinder Aster engines driving the d.c. generators which supply the station with light and drive the machines for charging the receiver batteries.

The first of the accompanying reproduced photographs shows the rectifying panels at the Bodmin transmitting station; behind them are mounted the "smoothing" units (which are illustrated in fig. 5), the well-known Marconi system of rectified alternating current being utilised at these stations. At the Bodmin station all the power required will be generated on site, and fig. 2 shows the machinery hall containing the plant referred to above. In striking contrast to this, fig. 3 is a view of the much smaller power plant needed at the Bridgwater receiving station; on the left are seen the switchboard and one of the small generating sets which supply the station lighting and drive the motor-generators (shown on the right) provided for battery-charging purposes. It will be noticed that the two lines of masts depicted in the last illustration are at right angles to each other, which arrangement provides for the left-hand row being used for the Canadian service, while the right-hand row of masts serves for the South African service.

Both transmitting and receiving stations will be connected by direct land lines with the Central Telegraph Office, G.P.O., London; the incoming signals will be automatically relayed to the land line at Bridgwater and passed on to the Central Telegraph Office, London, and the outgoing and incoming messages will be dealt with at the same table in the telegraph office, thus giving true duplex working and complete central control over the traffic. For the "beam" system, whereby the radiated energy is concentrated in one direction, very much smaller power is required for communicating over any given distance than in the case of high-power stations which radiate energy in all directions, while, in addition, the speed of working, and freedom from interference, are greatly increased.

Fig. 4.—Bridgwater Receiving Station, showing some of the Masts.

The corresponding stations in Canada, near Montreal, and South Africa, near Cape Town, are in practically the same state of advancement as the English stations, and other similar stations of the Imperial system are being erected at Grimsby and Skegness, in England, for communication with other stations at Poona, in India, and Melbourne, in Australia. In fact, at the present time the Marconi Company has in hand no fewer than 17 short-wave transmitting stations, including its own station at Dorchester, for communication with New York and South America.

Fig. 5.—Bodmin Transmitting Station: "Smoothing" Units for Rectifiers.

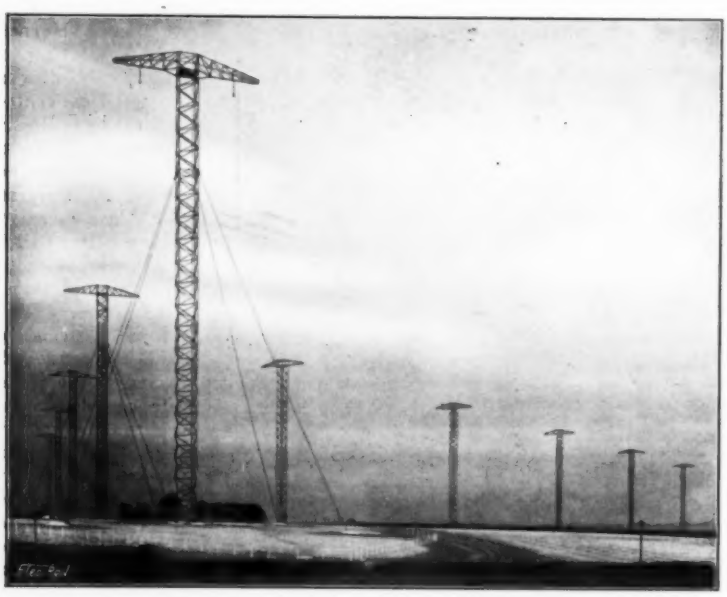


Fig. 6.—"Canadian" Masts (Left) and "South African" Masts (Right) at Bridgwater.

The Imperial stations have been designed and are being built by Marconi's Wireless Telegraph Co., Ltd., for the General Post Office, the buildings and foundations being carried out to the Marconi Co.'s design by the Foundation Co., of London. At Bodmin the masts have been supplied and erected by the Armstrong Construction Co., and at Bridgwater they have been erected by Messrs. Francis Morton and Co., who are also responsible for the supply and erection of the masts at the Grimsby and Skegness stations.

It is understood that probably two wave-lengths will be utilised at each station so that in the event of interference, or fading, being experienced on one, a change over to the other could be made. It will be recalled that the original intention was to have the stations in operation this month as specified by the Canadian agreement which was signed in July, 1924.

Electricity Supply at Maidstone.

Some Particulars of the Recently Inaugurated Extensions.

THE public supply of electricity in Maidstone was commenced in 1901, with plant consisting of four hand-fired boilers and five d.c. engine-driven generators, having a total capacity of 675 kW. In 1908 the buildings were extended, a 500-kW set and an additional boiler were

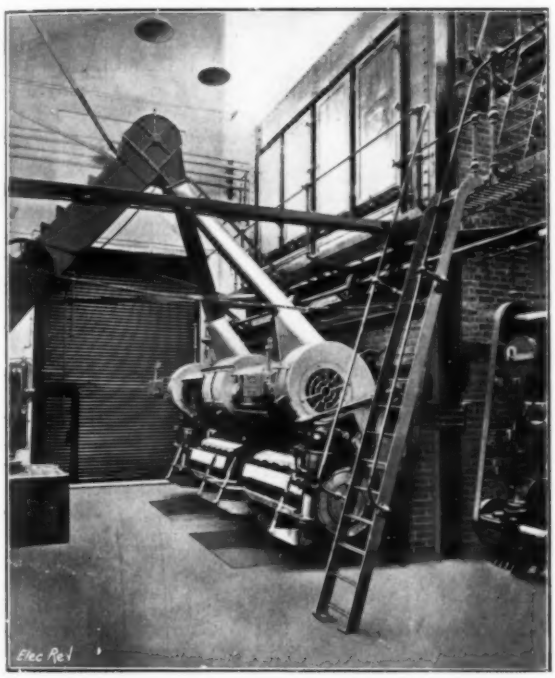


Fig. 1.—30,000-lb. Boiler with Underfeed Stoker.

installed, and mechanical stokers were fitted to the boilers. Additional plant became necessary in 1913, when a sixth boiler and another generator set, 825 kW, were added to the plant. Early in the war three of the old 150-kW sets were taken for "urgent Government requirements," and in their place were installed a 1,250-kW turbo-alternator and a 1,000-kW rotary converter. At a later date a second turbo-alternator, 1,500 kW, and a 30,000-lb. water-tube boiler were installed. In 1919 and 1920 the system of generation was changed to a.c., 3-phase, 50-period, 6,600-V, and a further 30,000-lb. water-tube boiler together with a third Brush-Ljungström turbine of 1,500 kW were put down. The recent extensions which were officially inaugurated on December 19th last (ELECTRICAL REVIEW, December 25th) include boiler and turbo-alternator plant, and the necessary switchgear, contained in a new ferro-concrete building, designed by Messrs. Mouchel & Partners, and erected by Messrs. Corben & Son, local builders.

The boiler plant was supplied and erected by Messrs. Vickers Boiler Co., Ltd., and comprises two water-tube boiler sets in brickwork, with a working pressure of 225 lb. per sq. in., and a heating surface of 6,000 sq. ft. each. They are fired by mechanical stokers, one having a stoker of the Bennis chain-grate type, and the other an Underfeed self-contained travelling-grate stoker, fig. 1, the grate area in each case being 170 sq. ft. Integral superheaters designed to give a final steam temperature of 650 deg. F., and a Green vertical economiser are provided with each boiler. A new draught equipment consists of one Louis Prat "Evasé" chimney, 80 ft. high, equipped with induced-draught fans. Two vertical direct-acting boiler feed pumps, each capable of dealing with 6,000 gallons of water per hour, one cast-iron hot-well tank having a capacity of 2,500 gallons, and two Bennis 8-in. bucket coal elevators are also installed.

A large panel placed opposite the front of the boilers accommodates the boiler instruments, including CO_2 recorders, pressure and draught gauges, and load indicators.

A 3,000-kW Brush-Ljungström turbo-alternator, fig. 2, with the necessary condensing plant and auxiliaries form the turbine generating plant. The turbine is direct coupled to two alternators having a combined output of 3,000 kW at 0.8 power factor, 6,600 V, 50 cycles, 3-phase, at 3,000 r.p.m. The condenser is of the two-flow surface type; it has a cooling surface of 4,000 sq. ft., and is capable of dealing with 35,500 lb. of exhaust steam per hour. Air is extracted from the condenser by means of a two-stage Brush-Delas ejector, capable of dealing with 20.75 lb. of dry air per hour. The condensate is removed by means of a Pulsometer centrifugal pump, and delivered to a Wright recorder, whence it is pumped to the hot well by a separate lift pump. The circulating water is delivered to the condenser by a motor-driven centrifugal pump of the Sunturbo type, made by Messrs. J. Stone & Co., Ltd., and a Carr's patent rotary screen, made by Messrs. Ledward and Beckett, deals with the circulating water. The coal handling plant was supplied by Messrs. Edward Bennis and Co., Ltd.; it consists of a conveyor trough incorporated with that previously existing so that fuel is fed in two directions at the same time, dealing with both coal borne by road and by rail. Installed at the river side is an electric crane which takes the coal from barges, and discharges it into a hopper serving an Avery weigher and totaliser.

A three-panel G.E.C. slate switchboard, with steel plate cubicles, accommodates the necessary switchgear and instruments. The alternator switchgear consists of an oil circuit breaker having a breaking capacity of 125,000 kVA, and provided with two overload and one shunt trip coils. Two sets of signal lamps indicate

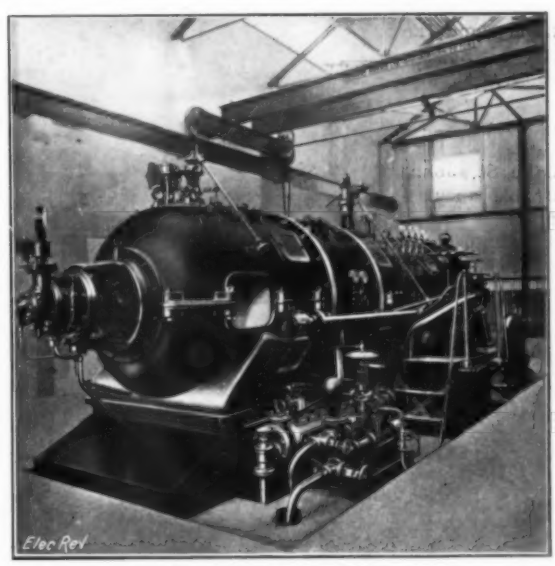


Fig. 2.—3,000-kW Turbo-Alternator.

whether the oil switch is in the "on" or "off" position, and whether the isolating switches are closed. A Brown, Boveri automatic pressure regulator is installed.

The total capacity of the station is now 8,575 kW, and the consumption of electricity per head of the population is about 400 kWh per annum.

The extensions to the plant were designed by the electrical engineer, Mr. E. E. Hoadley, M.I.E.E., who was assisted by Messrs. C. E. Winkle, E. E. Pope, and T. F. Maud.

A Large Hydro-Electric Development.

The New Generating Station at Isle Maligne, Quebec.

WHAT was to be completed by the middle of last summer, the first of two hydro-electric schemes projected by the Quebec Development Company for harnessing the waters of the Saguenay River at Isle Maligne, is claimed to be the largest single installation in water-power development ever undertaken. The Saguenay River is one of the great tributaries of the St. Lawrence River and flows out of Lake St. John by two channels, the Grand Discharge and Little Discharge. Lake St. John is located about 100 miles north of Quebec City. Its normal water level is 310 ft. above mean sea-level, and its drainage area is estimated to be 30,000 square miles. The Grand Discharge is divided into two channels by Isle Maligne, at the foot of which, in the left channel, fig. 1, is located the power house.

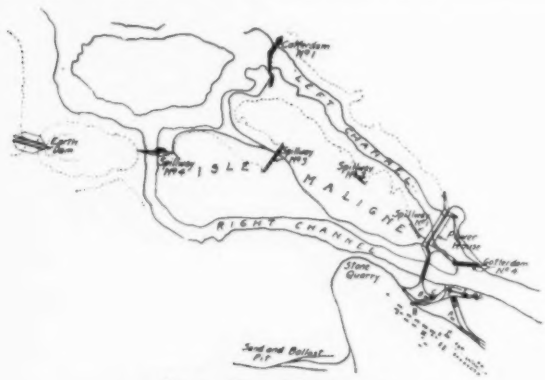


Fig. 1.—Plan of Development.

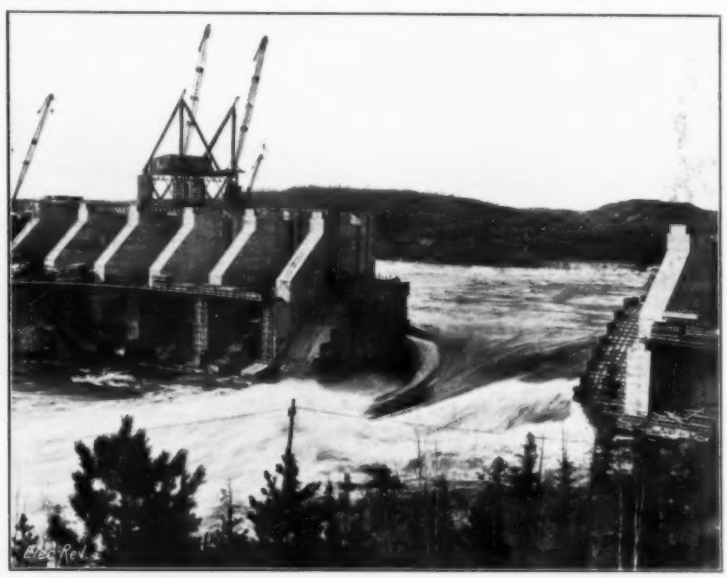


Fig. 2.—Main Dam, Isle Maligne, during Construction.

The main structure, fig. 2, consists of a combined gravity dam and power house, 720 ft. in length, with a bulkhead extension at the north end, 330 ft. long, inclined upstream at an angle of 30 deg., and tailrace walls carried downstream at either end at right angles to the building. The power house sub-structure and adjacent walls are built of concrete and the superstructure is built round a steel framing with brick and tile walls and a roof of reinforced gypsum slabs with tar and gravel finish.

The intake of each turbine is formed by twin rectangular openings, 16 ft. by 22 ft., in the concrete wall, each controlled by a butterfly valve. These converge into one, in which the rectangular section is gradually changed into a circular one, meeting the 22-ft. diameter steel penstock which carries the water to the steel-plate spiral casing. The latter surrounds and is riveted to the speed-ring, a massive cast-steel erection, 21 ft. 6 in. in diameter, consisting of top and bottom machine-faced flanges with interconnecting ribs between which the water is delivered to the runner. This is of cast iron, with a maximum diameter of 15 ft. It is cast in one section, and is connected to the generator by the main shaft, which is 28 ft. long and 29 inches in diameter.

In addition to the main structure, there are seven spillways and an earth dam to close up the channels and waterways and to direct all the water to the required channel only.

The construction of the station provides for the installation of 12 vertical, single-runner, Francis turbines, aggregating a total of 540,000 h.p. At the time of the preparation of our information eight turbine units were completely installed, and the foundations for the four additional machines were well advanced. The head on the turbines is between 100 and 120 ft., giving each a variation in horse power from 35,000 to 45,000. An individual governor system operating under an oil pressure up to 220 lb. per sq. in. is provided for each turbine, and the piping is so arranged that the governors may be operated separately or as an interconnected system of units in groups of four. The governor flyballs are directly connected to the turbine shaft below the rotor. The governor stands, gear-type oil pumps, pressure tanks

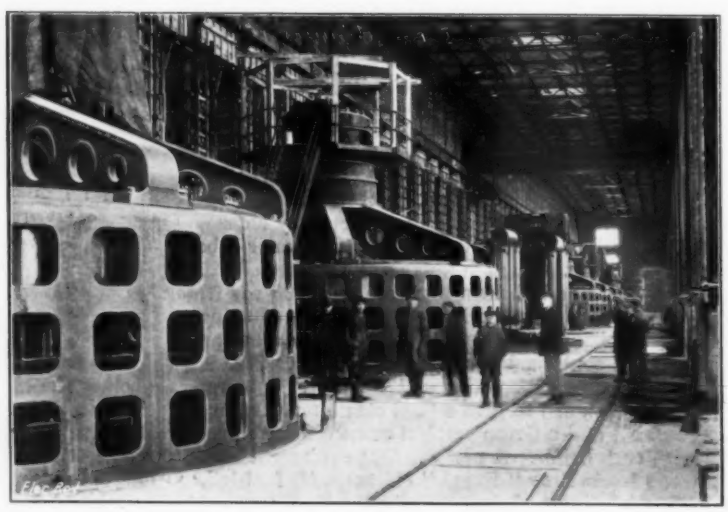
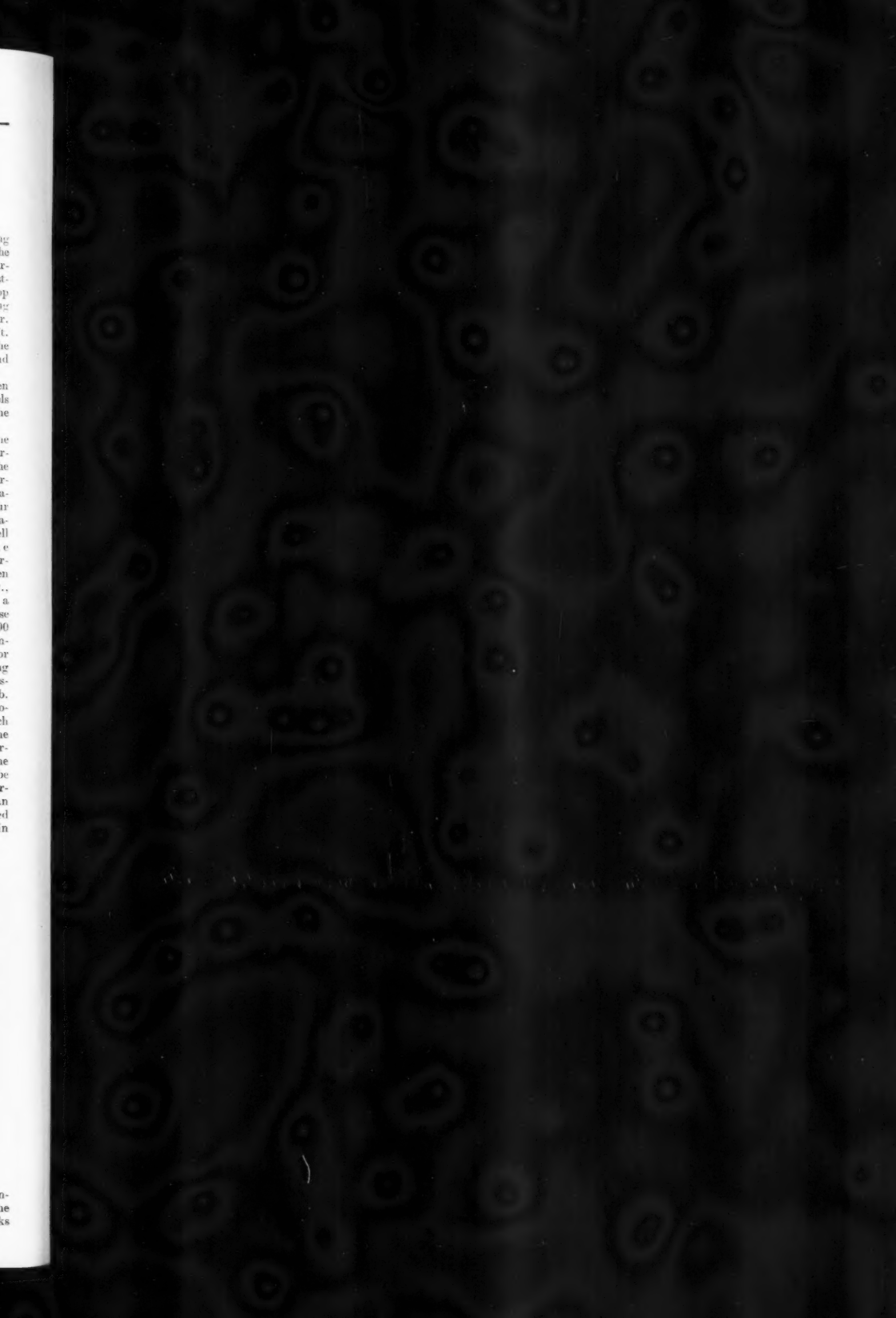


Fig. 3.—Interior of Power House.



and receiving tanks are located in the spacious power-house basement or turbine room. An emergency stop device is installed for each turbine, enabling the operator at the benchboard to shut the turbine gates and stop any machine without the assistance of an operator in the turbine room. The closing time for each of the governors is three seconds.

The eight generators directly connected to the turbines each have a continuous full-load rating of 30,000 kVA at 13,200 V, three phase, 60 cycles, 112.5 r.p.m. Each generator is equipped with an upper and a lower guide bearing. The thrust bearing on top of the generator is of the Kingsbury type, and its housing is provided with water-cooling coils. The individual exciters placed above the thrust bearings each have a full-load rating of 185 kW at 250 V.

The oiling system of each generator unit is self-contained and automatic in operation. The thrust bearing is immersed in an oil reservoir containing water-cooling coils located on top of the upper bearing bracket. A geared pump, mounted in a smaller oil reservoir located below the lower bearing bracket, is driven by a gear on the generator shaft and forces the oil to the upper thrust-bearing reservoir. Proper pipes also conduct the necessary oil to the two guide bearings, and the overflow oil from each bearing is carried back to the lower reservoir for re-circulation. Large brakes are provided for four of the eight arms of the lower generator-bearing bracket. If operated by air pressure, the brakes will stop the generator with the turbine gates closed, and if operated by oil pressure from the governor system, the brakes may be used as jacks to lift the rotor. Cast-iron stools are provided for mounting on the bracket arms to support the rotor when lifted.

Each generator armature is star-connected, and the six leads are brought out from the upstream side of the generator. By means of a 15,000-V disconnecting switch, the neutral point is connected to the neutral bus-bar consisting of a ¾-in. copper tube suspended by porcelain insulators on the mezzanine floor along the upstream side of the power house, and it is then earthed outside the station. Normally each generator feeds its own transmission line, and a low-pressure bus system provides for the transfer of energy from another generator in case of emergency and the means for delivering energy to the transformers for the station auxiliaries.

The rating of each circuit breaker is 3,000 A at 15,000 V, and the guaranteed interrupting capacity is 65,000 A at 13,200 V. An electrically-operated motor mechanism is provided for each breaker, and an arrangement is made for emergency manual operation. D.c. energy at 230 V, for the operation of the mechanism, is furnished from a 25-kW motor-generator set.

For the station use there are installed two banks of transformers, which are located in the centre of the high-pressure room, and each bank consists of three 200-kVA single-phase transformers stepping down from 13,200 to 550 V. Two 100-ton power-house cranes, a 100-ton crane for lifting and transferring apparatus from the generator room to the high-pressure room, a 60-ton gantry crane on top of the power house bulkhead, and 16 headgate hoist motors are installed.

For the actual construction of the power house, fig. 3, a steel trestle was built on the site of the structure and along its full length, carrying three lines of standard track and derrick gantry rails on either side. The whole of this trestle, with the exception of the floor members and the rail girders, is built into the dam.

During the construction an electricity supply was received from Chicoutimi, where Messrs. Price Bros., who are part owners of the development, have a hydro-electric plant, by means of a 44,000-V 40-mile transmission line.

We are indebted to Mr. W. S. Lee, chief engineer of the Duke Price Power Co., for the information given above, to the *Electrical News* (of Toronto) for the diagram, fig. 1, and to the Canadian National Railways for the photographs.

Lighting and Power Notes.

(*Continued from page 98.*)

Birmingham.—ELECTRICITY EXTENSIONS APPROVED.—At a meeting of the City Council on January 5th the chairman of the Electricity Supply Committee, moved a resolution authorising the latter to proceed with the installation of a 10,000-kW turbo-alternator set at a cost of £60,000. The resolution was adopted, and it was agreed to spend £158,000 on additional sub-stations and equipment and £260,000 on mains.

Bromley (Kent).—PRICE REDUCTION.—The Bromley Electric Light & Power Co., Ltd., has made a further reduction of 1d. per kWh in the charge for electricity for lighting. The revised rate is 7d. per kWh subject to a minimum charge of 8s. 9d. for the winter quarters and 5s. 10d. for the summer quarters.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—An official statement recently issued shows that new hydro-electric installations during the past year totalled 719,000 h.p., bringing the total to 4,290,000 h.p. The year's developments have involved a capital expenditure of $70,000,000, exclusive of the new capital required for the utilisation of the energy generated.—*Reuter's Trade Service* (Ottawa).

Clitheroe.—ELECTRICITY SUPPLY.—The Corporation is preparing for the early introduction of electricity in its area. The terms include a fixed charge for power purposes of £5 per kW of maximum demand, and ½d. per kWh, the consumer to provide a transformer station and the Corporation the transformer.

Continental.—SWEDEN.—It is announced from Stockholm that the hydro-electric station which has been established at Lilla Edet by the Swedish Government for the supply of power to the Stockholm-Gothenburg railway has recently been completed.

FRANCE.—The City Council of Paris has recently approved a large programme of works to be executed by the Compagnie Parisienne de Distribution d'Electricité with the object of coping with the continuous development of the consumption. The works will extend over several years, and will involve a loan of about 356 millions of francs.

GERMANY.—The Berlin correspondent of the *Daily Mail* reports that £3,000,000 is being spent on the erection of electricity works at Rummelsburg, on the outskirts of Berlin. Dr. Rehmer, the director of the works, states that the undertaking will be completed in the course of the year and that the plant will have a capacity of 160,000 kW.

Elland.—LOAN.—The Urban District Council has applied for sanction to a loan of £1,400 for street lighting in the north ward.

Hamilton.—TRANSFER OF UNDERTAKING.—The local electricity undertaking was recently formally transferred from Messrs. Edmundsons' Electricity Corporation, Ltd., to the Town Council.

Hebden Bridge (Yorks.).—LOAN.—The Urban District Council has made application for sanction to borrow £1,000 for the purchase of electric cookers and other domestic appliances, to be let out on hire.

Keighley.—EXTENSION OF SUPPLY.—The Town Council has authorised the Electricity Committee to proceed with the transmission line from Eastburn Foundry and the laying of mains for the purpose of a supply of electricity to the township of Sutton.

Liverpool.—LOANS.—The Corporation has received sanction to a loan of £200,000 for distributing mains.

The Tramways and Electric Power and Lighting Committee has made application for sanction to the borrowing of £69,799 for provision of h.p. and l.p. mains and services, and sub-station buildings and plant, for the supply of electricity to the Walton-Clubmoor, Highfield, Pinehurst Road, and Strawberry Lane housing estates.

MAINS EXTENSIONS.—The City Council has approved of the extension of mains in the Old Swan district at an estimated cost of £7,960, concurrent with the laying of a h.p. main from Lister Drive to Knotty Ash. Authority has also been granted for extension of mains in Higher Road, Hunt's Cross, at an estimated cost of £1,350.

Maidenhead.—OPPOSITION TO BILL.—The Town Council has decided to oppose the Bill of the Metropolitan Electric Supply Co. for powers to increase the area of supply which might encroach upon the powers of the Corporation undertaking.

LOAN.—Sanction has been received to a loan of £5,000 for mains and services.

Manchester.—PROGRESS DURING NOVEMBER.—During the month of November the Corporation electricity undertaking showed an increase in connections of 1,784 kW, bringing the total to 273,412 kW; and the number of applications received for supply, including existing consumers for additional supplies, was 1,052, representing a total of 2,942 kW. The number of consumers connected increased by 441, and the number of hired cookers connected by 81, bringing the total actually on circuit to 1,149. Applications for the hire of cookers totalled 108.

ELECTRICITY SUPPLY RECORDS.—On December 3rd, the output reached 1,575,920 kWh, and on December 15th, the maximum supply demanded reached 136,560 kW, both figures constituting records in the history of the undertaking.

Morecambe.—ELECTRICITY CHARGES.—At a recent meeting of the Town Council a letter was received from the Heysham Urban District Council, suggesting a joint arrangement for charging for electricity supplied from Morecambe to private houses in Heysham on the basis of the rateable value of the premises, plus a small charge per kWh. It was resolved that the Heysham authority be informed that the proposal was at present under consideration and would shortly be reported on by the borough electrical engineer. The Council also received correspondence from the Morecambe and Heysham Master Builders' Association, with regard to the revision of charges for laying electricity services in private premises. The electrical engineer submitted a revised table of charges for various classes of service, and the matter was deferred to the next meeting. The borough electrical engineer reported that the laying of an additional e.h.p. feeder cable had not been commenced owing to the L.M. & S. Railway Company's asking to be supplied with energy for working the Heysham branch electric line, and that would affect the direction in which the cable would be laid. There was a considerable portion of the feeder which would be common to both schemes, and the engineer was instructed to proceed forthwith with the laying of such portion.

Newport (Fife).—ELECTRICITY AGREEMENT.—The Newport Town Council has come to an agreement with the Fife Tramways Light & Power Co., Ltd., regarding the laying of cables in the burgh.

North-West Midlands Electricity District.—LOCAL INQUIRY.—In pursuance of the Electricity Commissioners' provisional determination of the above-named district, the Commissioners will hold a local inquiry at the Town Hall, Stoke-on-Trent, on February 17th, 1926, at 10.30 a.m. and following days, if necessary, with reference to the area to be included in the proposed district, and to consider a scheme which has been submitted by a Conference of Authorised Undertakers in the District for improving the existing organisation for the supply of electricity in the district and for the formation of a Joint Electricity Authority. Copies of the scheme may be obtained from Mr. H. H. Battle, hon. secretary to the Conference of Authorised Undertakers, Borough Hall, Stafford, at a cost of 10s. 6d. each. Representations with regard to the scheme should be addressed to the Secretary, Electricity Commission, Savoy Court, Strand, London, W.C.2, not later than February 6th, and a copy of such representations should at the same time be sent to the hon. secretary to the Conference at the address mentioned above.

Retford.—ELECTRICITY SCHEME.—At a recent special meeting of the Town Council it was agreed that the draft specification and tender form prepared by Mr. A. H. Seabrook for the new electricity scheme be accepted, and that a fee of £1,600 be paid on an estimated expenditure of £27,000. The plant, which is to be installed at the Corporation gasworks, will consist of one 50-kW steam-driven generating set and one 150-kW and one 250-kW gas engine-driven sets. The Committee was given power to increase the capacity as the demand arose.

Scarborough.—TRANSFER OF UNDERTAKING.—The formal transfer of control of the Scarborough electricity works from the Scarborough Electric Supply Co., Ltd., to the Corporation, under a recently agreed purchase arrangement, took place on January 1st, Mr. J. J. Addy, a director of the company, formally handing over the works to the Mayor.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electric Supply Committee has approved extensions of mains for general distribution purposes at an estimated cost of £21,843, and electricity extensions and works at an estimated outlay of £3,705.

South Africa.—JOHANNESBURG.—The Johannesburg correspondent of *The Times Trade and Engineering Supplement* reports that the Town Council has failed to obtain from the Transvaal Provincial Council the necessary sanction to a proposed expenditure of £500,000 on a new power station, the Provincial Administrator taking the view that the town could more economically supplement its existing supply by an arrangement with the Electricity Supply Commission, on whose behalf the Victoria Falls and Transvaal Power Co. is at present erecting a super station on the Witbank coalfield. The Council, being already committed to an expenditure of over £20,000 on the scheme, has decided to carry out the proposed extensions by means of a 10 per cent. addition to the existing plant annually, which it is empowered to do without reference to the Provincial Authority. Already a new 10,000-kW set is being installed, but it is doubtful if this will be sufficient to meet the needs of the town during the next winter. Although the Victoria Falls and Transvaal Power Co. generates electricity at a cost which enables it to supply the requirements of the gold mines of the Witwatersrand at less than 4¼d. per kWh, the Johannesburg Town Council estimates that it can generate at a still lower cost and effect a saving of about £23,000 per annum, as compared with the cost of taking a supply from the company.

South-East Lancashire Electricity Advisory Board.—*Electricity Supply for Eccles.*—The Engineering Advisory Committee has considered the question of a bulk supply to Eccles Corporation, and has decided that in the interest of the district, it is of opinion that the supply to Eccles should be furnished from the Barton station of the Manchester Corporation, but that as the Agecroft station is a possible alternative source of supply, the Eccles Corporation be recommended to invite offers for its requirements from the Lancashire Electric Power Co. and the Salford Corporation upon conditions defined by the Committee.

Main Transmission Line.—The Committee has recommended the Board to approve the construction of the 33,000-V transmission line by the Lancashire Electric Power Co. and Rochdale Corporation.

Bulk Supply to Leigh.—The question of a bulk supply to Leigh Corporation has been considered, and the Committee has decided that the proper source of the bulk supply required by the Corporation is the Barton power station, *via* the Lancashire Electric Power Co.

Alderley Power Station Extension.—The consideration of the application of the Alderley and Wilmslow Electric Supply, Ltd., for permission to install an additional 120-kW Mirrlees Diesel engine, direct coupled to a 3-phase, 50-cycle alternator, was adjourned.

The minutes of the proceedings of the Committee have been adopted by the Board.

Southport.—NEW PLANT.—In view of the increasing maximum load on the station, the borough electrical engineer (Mr. E. Moxon) has suggested to the Electricity Committee that it should approach the Electricity Commissioners with reference to the installation of a 6,000-kW turbo-alternator. This would be required for service in the winter of next year.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Birmingham Corporation to supply electricity in the rural district of Solihull, and part of the rural district of Meriden, and the Isle of Wight Electric Light & Power Co., Ltd., to supply in the rural district of the Isle of Wight.

Applications have been made for Special Orders by the following authorities:—The Brighton Corporation to supply electricity in the parish of Telscombe, and to revoke the Order granted under Section 6 of the Electric Lighting Act, 1909; and Norwich Corporation to supply in the urban district of North Walsham and certain parishes in the rural districts of Aylsham, Blofield, Forehoe, Henstead, Loddon and Clavering, Mitford and Launditch, Smallburgh, St. Faiths and Wayland.

Sutton Coldfield.—ELECTRICITY EXTENSIONS.—The Borough Council is applying for sanction to the borrowing of £28,650 for improvements and alterations to plant. The electrical engineer (Mr. T. Bloore) states that whilst the present plant should meet satisfactorily the winter demand, it would be advisable to make further provision at Roland Road power station and the Lime Grove sub-station in readiness for the winter of 1926-27. On December 4th the maximum load on the undertaking was 1,102, against 783 kW last year. Further provision is necessary, in view of the probability of supplying in the near future the districts of Streetly and Little Aston.

Truro.—ELECTRICITY SUPPLY.—The City Council has approved the proposed agreement with Messrs. Edmundsons and the draft of the Special Order in connection with the electricity supply for the district.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—The *Electrical World* reports that work is now actually under way on the Bucks Creek development of the Feather River Power Company in Northern California, to cost $8,500,000, and equipment for the two 32,000-h.p. impulse waterwheels and the two 25,000-kVA generators will soon be ordered. The development is being made by the Feather River Power Company of San Francisco, and upon completion of the project in August, 1927, the entire output of the plant will be sold to the Great Western Power Company. In consideration of the price to be paid for the power the plant is to become the property of the Great Western Power Company at the end of 35 years.

The House of Representatives, by 248 to 47 votes, has authorised the creation of a Joint Congressional Committee empowered to negotiate a private lease for the nitrate and water-power project constructed in war time at Muscle Shoals, at the confluence of the Tennessee and Alabama rivers.

Wath-on-Dearne.—ELECTRICITY IN SMALL HOUSES.—It was reported at a recent meeting of the Council that the Dearne Valley Electric Board had decided to allow householders to extend the payment of the cost of installation of electricity in their houses over a period of five years. This will amount to about 1s. 6d. per week per house.

Wimbledon.—ELECTRICITY SUPPLY.—The Electricity Committee has decided to lay new feeder mains at a cost of £12,250, and to enlarge and re-equip five sub-stations at a cost of £3,200.

Worcester.—ELECTRICITY EXTENSIONS.—The City Council has authorised the Electricity Committee to spend £3,000 on account of the £33,000 sanctioned, to procure plant for the supply of electricity to the extended area. It was stated at a recent Council meeting that the Electricity Commissioners' consent to the scheme was expected about the middle of January.

Worthing.—LOANS.—The Electricity and Waterworks Committee has recommended to the Town Council that application be made for sanction to the borrowing of £10,500 for plant and cables in connection with the supply of electricity to the East Preston rural district, and £12,635 for a Diesel engine and dynamo, &c.

Tramway and Railway Notes.

Continental.—SWITZERLAND.—The Swiss Federal Railway Authorities in Berne have recently issued a report on the progress of the electrification of the Swiss railways, which shows that, excluding the lake valley lines, about 488 miles of the system have so far been converted to electric traction. All the lines, with the exception of about 47 miles, are operated on the single-phase a.c. system. Additional sections of the system are being electrified at the rate of about 125 miles per year. The Palezieux-Geneva section will soon be completed; the Zurich-Rapperswil line will be completed next summer; the Brugg-Biel line and the Brigniue-Sitten line by the end of 1926; the Winterthur-St. Gall-Rorschach, Rothkreuz-Rupperswill and Palezieux-Freiburg-Berne sections by the summer of 1927; the Richterswil-Chur, and the Winterthur-Romanshorn-Rorschach lines by the summer of 1928; the Biel-Delsberg and the Zurich-Schaffhausen lines by the end of 1928. The length of the track in hand is about 490 miles, which will bring the total of electrified lines in Switzerland, including the lake valley lines, to approximately 1,010 miles by the beginning of 1929. This represents about 56 per cent. of the Swiss railway system.

GERMANY.—Inquiries are being made into the possibilities of economies in working by electrifying the railway between Frankfort-on-Main, Mannheim and Basle. It is considered that the necessary electrical energy could be supplied by the hydro-electric stations on the Upper Rhine.

Japan.—NEW ELECTRIC RAILWAYS.—It is reported that a contract has been given to the Kawakita Denki Kigyosha, of Tokio, by the Nasu Electric Railway Co., Ltd., for the construction of an electric railway between Kurodahara station on the Government north-eastern line and the Nasu Yumoto hot springs, a distance af ten miles.

The Uyeda Onsen Denki K.K. is to proceed with the construction of the suburban electric railway at Uyeda, Shinshu.

The Odawara Rapid Transit Railway Co., will shortly commence work on the line from Shinyuku to Odawara, a distance of 60 miles. The line will be opened for traffic in May, 1927.

Liverpool.—TRAMWAY EXTENSIONS.—The Ministry of Transport has sanctioned the borrowing by the Corporation of £91,102 for the purpose of constructing tramways authorised by the Liverpool Corporation Tramways Order, 1925. The Tramways Committee intends to apply for sanction to borrow £6,132 for the construction of tramways connecting Great Crosshall Street with Tithebarn Street, and the construction of an additional junction at the corner of Great Crosshall Street and Byrom Street.

London.—TUBE "SPEED-UP."—In the course of the next eighteen months the rolling stock of the Central London Tube is fo be remodelled and refitted throughout, to provide the same standards of comfort and efficiency as are now afforded on the Hampstead and City lines, at a cost of £200,000. The first of the 250 new coaches is already in commission, and a recent experiment demonstrated that passengers alighted from it in 12 seconds, as against 28 seconds taken by passengers in an adjoining coach. This is due to the substitution of pneumatically controlled doors, giving access immediately into the compartment, for the manually-operated and much smaller gates at the ends of the coaches. The improvements include more commodious seats, better lighting, and better ventilation. Instead of four motors on the six-seven car trains, there will be six, and this increase of power will, it is estimated, enable four minutes to be saved on the through journey. Six trains will be running by Easter.

INQUIRY.—It is anticipated, according to the Finance Committee of the Camberwell Borough Council, that the inquiry to be held by the London and Home Counties Traffic Advisory Committee into the question of the provision of tube railways for the South-East London district will be held about the end of the present month.

Newcastle-on-Tyne.—LOAN.—According to the *Financial Times*, subject to the assent of the ratepayers under the Borough Funds Act, the Corporation is applying to Parliament next session for power to borrow £2,147,125. Of this sum £118,125 is the amount proposed to be paid for the purchase of the undertaking of the Tyneside Tramways and Tramroads Co., and £71,500 is for improvements to the tramway system.

Telegraph and Telephone Notes.

France.—INCREASED TELEGRAPH AND TELEPHONE RATES.—The further fall of the franc has been followed by a fresh increase in foreign telegraph and telephone rates. The basic rate now has to be multiplied by 5.3 for international messages, as compared with a multiplication by 4 at the beginning of August, 1925, and by 5 on December 10th, 1925. Contrary to the practice obtaining hitherto, substantial increases have also been made in French colonial rates, the same multiplier index being applied as for international telegrams except in the case of messages sent to French colonies by wireless, or *via* Dakar, in which case the basic rate will be multiplied by 3.5 only.—*Reuter* (Paris).

Germany.—AUTOMATIC TELEPHONY.—Despite the financial difficulties attending the introduction of new methods by the post office authorities, the introduction of the automatic telephone system has made rapid progress in Germany. A beginning in this respect was first made in 1907 by the conversion of the Hildesheim network to the automatic system, but further work was interrupted by the war and in the three years immediately following, and it was only possible to make a fresh start in 1922 in a systematic manner. As a manual exchange only has a life of about 15 years and many exchanges have to be annually renewed, it was decided in the latter cases to change over to the automatic system as being more appropriate, notwithstanding the additional expenditure involved of from 50 to 100 per cent. above the cost of manual exchanges; on the other hand, the automatic system results in a saving of labour and of other working expenses. The aim of the postal authorities now is to completely transform the local networks within a period of 15 years. At present in the old Reich telegraph area there are 33 large exchanges with 105,000 automatic connections, 29 medium exchanges with 10,000 automatic connections, and 113 exchanges with 8,000 such connections, and preparations are being made for the conversion of a similar number of other exchanges. The course of the financial position will determine whether the 15 years' programme will be entirely carried out.

Peru.—MARCONI CONCESSION.—One of the most bitterly contested concessions in the recent legislative history of Peru terminated with the Senate's ratification of the Marconi contract for twenty-five years for the administration of the Peruvian post, telegraph and wireless services. The concession has been in effect under a referendum clause since 1921, though the opposition of politicians and private interests threatened its annulment, says the *Financial Times*. It is understood that its ratification coincides with the initiation of an energetic construction programme, including the erection of a "beam" station for communicating with the United States, Buenos Aires, Rio de Janeiro and Bogota. The programme provides for expenditure exceeding £500,000.

The Telephone Service.—POLICE SIGNALLING DEVICE.—A new system of police signalling is being tried in the provinces. At some twenty sites in the borough of Halifax telephone boxes have been placed, and in an elevated position near them are fixed coloured lights; by the latter the officer on duty at the police station can call the attention of a constable on beat in the neighbourhood, who will at once go to the telephone box for instructions.

LONG-DISTANCE SERVICE.—It is understood that London will shortly be able to communicate by telephone direct with Wick, a distance of about 730 miles, when junction apparatus has been installed. This installation will also link the extreme north of Scotland with Penzance and enable subscribers to talk from Penzance to Wick, a distance of about 850 miles. At present Inverness is the farthest north town in Great Britain that can be telephoned to direct from London.

SERVICE RESTORATION FEE.—The Postmaster-General has decided that a fee of five shillings will in future be charged to telephone subscribers in every case in which delay in payment of an account leads to the withdrawal and restoration of telephone facilities. The cost entailed by temporary suspension of the service owing to non-payment has now reached a sum of about £25,000 per annum.

MANCHESTER'S NEW EXCHANGE.—Some 4,000 tons of steel will be required for Manchester's new main telephone exchange, the contract for building which has just been placed with a local firm, Messrs. Gerrard, of Swinton. It will take three years to complete, will occupy a floor space of six acres, and will cost altogether some £250,000; its ten floors will house a staff of 1,500. Three units of automatic apparatus, each dealing with 10,000 lines (30,000 lines in all) will be accommodated in the building, which has been designed by Mr. C. P. Wilkinson, of H.M. Office of Works.

SWANSEA DOCKS INSTALLATION.—In order to improve the telephone facilities at Swansea Docks, the Great Western Railway Co. is installing an enlarged branch exchange in the docks offices, which will enable all important parts of the docks to be linked up and provide for both dock traffic control and marine control. The existing exchange in the High Street will be abolished and the lines now connected therewith transferred to the new exchange.

United States.—NEW YORK TELEPHONE RATES.—The New York Telephone Co. has filed a supplemental complaint in the District Court in its action against the Public Service Commission and the Attorney-General of New York, seeking to restrain them from enforcing the rates last set by the Commission. The Company asks that the 10 per cent. surcharge on local rates in New York City allowed by Federal Judge John C. Knox, on May 1st, 1924, be increased to 35 per cent.; also that it be allowed to increase its charge within the State sufficiently to show a fair return on the value of its properties. The Company alleges that, after including the present 10 per cent. surcharge now applied to New York City, the rate level collected there is only 12.9 per cent. over the 1914 level, while living costs have increased 68.5 per cent. in the same period. The Company, after including money derived from the application of the surcharge of 10 per cent. in the city permitted by the terms of the injunction, has been able to earn only 3.96 per cent. on its property devoted to the service in the city and only 4.28 per cent. on its entire property used in the service throughout the State. The property, the Company asserts, has a value largely in excess of $500,000,000.—*Financial Times.*

Radio Notes.

Broadcast Wave-lengths.—SOME PROBABLE CHANGES.—The International Broadcasting Conference, first held at Geneva and recently at Brussels, has accepted the principle that the broadcast wave-band should be extended, the proposed limits being 200 and 600 meters inclusive. On account of shipping interference, no British station will be permitted to use a longer wave than 550 m., whilst 250 m. is probably the lowest limit that can be reached by the existing types of receiving sets; if it is found necessary to operate a British station below 250 m., at least a year's notice will be given, so that present sets need not be modified before March, 1927 (the Commission's findings will probably be published in March next). Moreover, the use of waves shorter than 300 m. is subject to the permission of the Post Office authorities. The Conference has adopted the principle of the allocation of exclusive and non-exclusive wave-lengths, and will respect the seniority of the longest-established stations so far as is possible. The *Evening News* says that Capt. P. P. Eckersley, chief engineer of the B.B.C., left for Brussels on January 11th, where the Conference met again, and is resigning his presidency of its technical section in order to retain an unbiased position.

India.—BROADCASTING COMPANY.—The Indian Radio Telegraph Co., which is building "beam" stations in connection with the Empire wireless chain, has been granted a licence by the Government of India to form a separate broadcasting company for India, with stations in Calcutta and Bombay. The capital of Rs.15,00,000 is all underwritten, it being an entirely Indian company with Indian capital. The *Daily Telegraph* expects that both stations will be working at the beginning of 1927. The income of the company will be 80 per cent. of the licence fees, and the remainder will go to the Government.

United States.—BROADCASTING HELPS FARMERS.—A complaint received by the State Railroad Board shows that the installation of radio receivers by farmers enables them to listen to the market and receive earlier returns, so that if the market falls they can sell their stored grain before the elevator operator learns of the change in price. The Board admits that the situation may be a difficulty for the elevator man, but says that the Board can do nothing in the matter.—*Reuter's Trade Service* (Bismark, N.D.).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—March 16th. Postmaster-General's Department. Battery-charging power board equipment.*

March 23rd. Telephone switches.*

March 29th. State Electricity Commission. Transformers and auxiliary apparatus.*

Bath.—January 29th. Electricity Department. One 6,000-kW turbo-alternator, one water-tube boiler, mechanical stoker and economiser, and one 1,000-kVA transformer. (See this issue.)

Belgium.—ANTWERP.—February 1st. Municipal Council. Electric motor-driven centrifugal pump.*

Blackpool.—January 23rd. Electricity Department. One 2,500-kVA phase and frequency changer. (January 1st.)

Clitheroe.—January 20th and February 23rd. Corporation. Transformers, switchgear, and cable connection for sub-station; e.h.p. and l.p. cables, boxes, &c. (See this issue.)

Dewsbury.—January 23rd. Town Council. Reciprocating electrically-driven sludge pumps with motors and electrical equipment for Mitchell Laithes sewage disposal works. Specification from Mr. H. Dearden, borough engineer, Town Hall.

Edinburgh.—January 25th. Tramways Department. 25 air brakes suitable for electric tramway cars. Specifications from manager.

Grimsby. — January 30th. Electricity Department. 500-kW traction converting plant, sub-station e.h.p. switchgear, e.h.p. feeder and pilot cables. (See this issue.)

Ilkley.—January 20th. Electricity Department. Feeder cables, distribution cables, feeder pillars, and network boxes. (January 1st.)

India.—March 8th. India Store Department. 40 electric freight locomotives in connection with the G. I. P. Railway electrification. (See this issue.)

Liverpool.—January 28th. Electricity Department. Twelve months' supply of cables, meters, electrical sundries, electric lamps, &c. (See this issue.)

London.—METROPOLITAN ASYLUMS BOARD.—January 27th. Installation of electric lighting at the Darenth Colony, Dartford (approx. number of points, 2,300).

E.C. January 30th. Marryat & Place. 113,000 5-amp., 220-V tumbler switches. (January 8th.)

LONDON COUNTY COUNCIL.—January 25th. 4,425 tons of standard steel girder tramway track rails, fishplates and fish-bolts, and about 600 tons of conductor rails. Specifications from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

ISLINGTON.—January 28th. St. Mary's Board of Guardians. Installation of electric lighting at Andover Row schools. (See this issue.)

Lye.—January 16th. Worcestershire E.C. Electric lighting installation, Valley Road and Orchard Lane schools. Mr. A. V. Rowe, county architect, 38, Foregate Street, Worcester.

Manchester.—January 29th. Electricity Committee. Wiring for electric lighting and power circuits, offices, stores, and workshops at the High Street depôt, Chorlton-on-Medlock. Specification from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

New Zealand.—WELLINGTON.—March 8th. New Zealand Government Railways. Two 25-h.p. variable-speed motors, one 125-kW motor-generator set and 17 400-V, 3-pole switches.*

Plymouth.—February 4th. Electricity Department. One 6,000-kW turbo-alternator, condenser, &c.; one 350-kW converter. (See this issue.)

Sheffield.—January 18th. Electric Supply Department. Erection of stores and ambulance room, on site of Neepsend generating station, Club Mill Lane. Particulars from Mr. S. E. Fedden, general manager and engineer.

South Africa.—JOHANNESBURG.—S.A. Railways and Harbours. February 25th. Electrically-operated hoists for raising, &c., heavy locomotives, electrically-driven geared winches, &c.*

CAPE TOWN.—January 27th. Electricity Department. Oil-cooled transformers.*

Tenterden (Kent).—January 27th. Board of Guardians. Electric lighting installation at the Institution. Master of the Institution.

Uruguay.—MONTEVIDEO.—February 26th. State Electricity Works. Diesel oil engine and a direct-coupled generator.*

Walthamstow.—January 27th. U.D.C. Electricity Department. Two water-tube boilers, mechanical stokers, economisers and pipework, &c. (January 8th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—The Société des Ateliers de Constructions Radiophoniques, of Brussels, has lately secured a contract for the supply of wireless apparatus for the aeroplane section of the Belgian Army.

Bradford.—Tramways Committee.

Three railless vehicles, with one spare set of equipment (£4,913).—Associated Equipment Co., Ltd.
Three ditto, and spare equipment (£5,040).—Richard Garrett & Sons, Ltd.
50 chrome steel axles (£286).—Vickers, Ltd.

Electricity Committee. Accepted:—

Supply and erection of radiant heat superheater at Valley Road works.—Power Speciality Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—

Three 50-kVA transformers and three 100-kVA transformers (£847).—Metropolitan-Vickers Electrical Co., Ltd.

Glasgow.—Corporation. Accepted:—

Conversion of two existing service lifts at Govan Town Hall into electrically-controlled lifts (£106).—A. & P. Stewen, Ltd.

Irish Free State.—The following contracts were among those placed by the Controller of Stores, Posts and Telegraphs, Dublin, from November 23rd to December 21st, inclusive:—

Cable.—Siemens-Schuckert (Ireland), Ltd., and Routledge & Co.
Electric lamps.—E. C. Handcock; Sphinx Electric Supplies (Ireland), Ltd.
Bronze and copper wire.—W. F. Dennis & Co., Ltd.
—*Irish Builder and Engineer.*

Lamp Contract.—The Admiralty has placed a contract for carbon-filament lamps with the Edison Swan Electric Co., Ltd.; and the British Thomson-Houston Co., Ltd., has received a six months' contract for the supply of "Mazda" lamps from the Great Northern Railway Co. (Ireland), Ltd.

Leeds.—Electricity Committee. Accepted:—

Supply of transformers for two years.—British Electric Transformer Co., Ltd.
Cables.—Enfield Cable Works, Ltd. (£1,491); W. T. Henley's Telegraph Works Co., Ltd. (£1,358).

Leicester.—Tramways Committee. Accepted:—

Special trackwork in manganese steel (£1,999).—Hadfields, Ltd.

London.—METROPOLITAN ASYLUMS BOARD.—Works Committee.

Renewal of electric lighting cables at Brook Hospital:—

T. Clarke & Co., Ltd. (Accepted.)	**£430**
G. E. Taylor & Co.	460
Riddle & Goddard, Ltd.	490
Toy & Winslow	546
V. G. Middleton & Co., Ltd.	575
Read & Partners, Ltd.	695

HACKNEY.—Electricity Committee. Recommended:—

Two 10-ton overhead travelling cranes (£407).—Herbert Morris, Ltd.

SOUTHWARK.—Electricity Committee. Recommended:—

Reconstruction of generating set (£5,136).—Fraser & Chalmers, Ltd.

Manchester.—Housing Committee. Accepted:—
Electric lighting installation at houses on the Openshaw estate.—Armstrong and Co. On the Withington estate.—A. Spreadborough.

Marlborough.—Town Council. Accepted:—
Conversion of street lamps for electric lighting (£591).—James Bros.

Oldham.—Electricity Department. Accepted:—
Three 12,500-kW turbo-generator sets and condensers for the new power station.—Metropolitan-Vickers Electrical Co., Ltd.

Portsmouth.—Electricity Committee.
Four carbon-dioxide recorders (£340).—Jas. Gordon & Co. (Accepted.)
Cables (£946).—Johnson & Phillips, Ltd. (Recommended.)

Salford.—The Council on January 7th accepted the tender of the Nederlandsche Kabelfabrick, of Delft, Holland, for the supply of cable to the Electricity Committee for £1,792. The lowest offer by a British firm was £717 more than that of the Dutch company. Inquiries were made as to whether the conditions of employment under the Dutch firm were satisfactory, and no contrary report was received. Some opposition was raised to the order being given to a Dutch firm, to which it was replied that trade was reciprocal, and if there was no buying abroad on the part of this country we could not sell goods abroad.

Shrewsbury.—Electricity Committee. Recommended:—
600-b.h.p. 6-cylinder 4-cycle heavy oil engine, 400-kW Rees Roturbo generator, switchboard panel, 8-ton crane, &c. (£8,137).—Bellias and Morcom, Ltd.

Stockton-on-Tees.—Board of Guardians. Accepted:—
Installing electric lighting at Portrack Lodge (£332).—T. B. Watson and Sons, Ltd.

Torquay.—The Electricity Committee quotes £2 5s. per house for wiring 100 houses now being erected by the Newton Abbot U.D.C. at the Broadlands estate.

Woolwich.—Town Council. Accepted:—
Cables in connection with the bulk supply of electricity to Erith and Bexley (£13,261).—Standard Telephones & Cables, Ltd.

Worcester.—City Council. Accepted:—
One 6,000-kW turbo-alternator, with accessories (£23,758).—British Thomson-Houston Co., Ltd.
Continuous-flow condenser (£6,200).—G. & J. Weir, Ltd.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, January 15th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "The Characteristics of Electric Lamps in Relation to their Testing," by Messrs. B. P. Dudding and G. T. Winch.

Institution of Mechanical Engineers.—Friday, January 15th. At the Institution, Storey's Gate, S.W. At 7 p.m. Discussion on "Novelties at the 1925 Engineering Exhibition."

Manchester Electro-Harmonic Society.—Friday, January 15th. At the Albion Hotel, Piccadilly, Manchester. Concert.

Electrical Development Association Conferences.—Friday, January 15th. At Caxton Hall, Westminster, S.W. Lecture on "Suggestion and Auto-Suggestion in Salesmanship," by Mr. Ll. B. Atkinson.

Electrical Trades Commercial Travellers' Association.—Friday, January 15th. At E.L.M.A. Lighting Bureau, 15, Savoy Street, W.C.2. At 7 p.m. Lecture, "Demonstration of Lighting," by Mr. W. E. Bush.

Salford Technical and Engineering Association.—Saturday, January 16th. At the Royal Technical College. At 7 p.m. Presidential address by Mr. J. Morris.

Faraday Society.—Monday, January 18th. At Burlington House, W. At 5.30 p.m. Ordinary meeting.

Junior Institution of Engineers (North-Western Section).—Monday, January 18th. At the Manchester Geographical Society, 16, St. Mary's Parsonage. At 7.30 p.m. Lecture on "The Importance of the Selling Aspect of Production Planning," by Mr. W. D. Adamson.

Royal Institution.—Tuesday, January 19th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "X-rays and Living Matter," by Dr. J. A. Crowther.
Friday, January 22nd. At 9 p.m. Lecture on "The Work of the Davy-Faraday Research Laboratory," by Sir William Bragg.

Paisley Association of Engineers.—Tuesday, January 19th. At the Paisley Technical College. At 7.30 p.m. Lecture on "The Spectrum Visible and Invisible," by Principal A. McLean.

Association of Mining Electrical Engineers (London Branch).—Tuesday, January 19th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. Paper on "Rescue Apparatus for Mines," including demonstration of certain apparatus by Messrs. Siebe Gorman, Ltd.

(South Wales Branch).—Saturday, January 16th. At Cox's Café, Queen Street, Cardiff. At 6.30 p.m. Annual dinner. Visit of the president, Mr. Theodore Stretton.

Electrical Contractors' Association.—Tuesday, January 19th. At the Trocadero, Piccadilly Circus, W.1. At 6.30 for 7 p.m. Annual dinner.

Edinburgh Electrical Society.—Wednesday, January 20th. At the Royal Scottish Society of Art, 117, George Street. At 8 p.m. Paper on "Maintenance," by Mr. J. M. Couch.

Electrical Power Engineers' Association (West Yorks. Section).—Wednesday, January 20th. At the Cinema Exchange Theatre, Queen's Arcade, Briggate, Leeds. At 7 p.m. Paper on "Boiler Plant Efficiency: Some Practical Considerations," by Mr. B. Samuels.

Institution of Electrical Engineers.—Thursday, January 21st. At the Institution, Victoria Embankment, W.C.2. At 6 p.m. Paper, "Notes on the Testing of Static Transformers," by Messrs. J. L. Thompson and H. Walmsley.

(Irish Centre, Dublin).—Thursday, January 21st. At Trinity College, Dublin. At 7.45 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 18th. At The University, Liverpool. At 7.30 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(North-Western Centre).—Tuesday, January 19th. At the College of Technology, Manchester. At 7.30 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(North-Midland Students' Centre).—Tuesday, January 19th. At the Hotel Metropole. At 7 p.m. Address by the chairman of the Centre, Mr. S. Derwen Jones.

(London Students' Section).—Friday, January 22nd. At the Institution, Victoria Embankment. At 6.15 p.m. Paper on "Switchgear," by Mr. C. F. George.

Institution of Electrical Engineers—(*continued*).

(East Midland Sub-Centre).—Tuesday, January 19th. At the College, Loughborough. At 6.45 p.m. Paper on "Justifiable Small Power Plants," by Mr. A. B. Mallinson.

(Sheffield Sub-Centre).—Wednesday, January 20th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Short addresses on "Regulations," by Messrs. G. H. Nelson, H. W. Walker, D. M. Rait, and D. H. Davies.

(Tees-side Sub-Centre).—Monday, January 18th. At the Cleveland Technical Institute, Middlesbrough. At 7.15 p.m. Informal discussion on "The Isolation, Location and Repair of Faults," to be opened by Messrs. E. E. Dunn and W. S. Ramsdale.

Illuminating Engineering Society.—Thursday, January 21st. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7 p.m. Discussion on the "Lighting of Coal Mines," to be opened by Mr. E. Farmer.

Institution of Production Engineers.—Friday, January 22nd. At the Society of Motor Manufacturers, Ltd., 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Features of Machine Tools which make for Increased Production," by Mr. G. W. Rawlings.

Physical Society of London.—Friday, January 22nd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary Scientific Meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

TAIFUN electrical ventilators.
BEAR portable punches.

Notes.

Appointments Vacant.—Assistant telegraph superintendent (Rs. 500 per cal. month), for the Burma Railways Co., Ltd.; female cooking demonstrator and show-room attendant, for the Cardiff Corporation Electricity Department; plumber-jointer, for the Penmaenmawr U.D.C. Electricity Department; electrical engineer and electrical assistant, for the Bettwa-y-Coed U.D.C. Electricity Department; lecturer in preliminary technical studies (£400), for the Cape Technical College; plumber-jointer for the Stepney Corporation Electricity Department. (See our advertisement pages to-day.)

The British Association.—This year's meeting of the British Association for the Advancement of Science is to be held at Oxford from August 4th to 11th under the presidency of the Prince of Wales. The name of the president of the Engineering Section is to be announced later. Dr. A. Fowler, Research Professor of the Royal Society, is to be president of the Mathematics and Physics Section; Dr. J. F. Thorpe, Professor of Organic Chemistry at the Imperial College, is to be president of the Chemistry Section; and Sir Josiah Stamp is to be president of the Economics Section.

Local Societies.—BIRMINGHAM ELECTRIC CLUB.—The following officers for the year 1926 were appointed at the annual meeting, held on December 18th:—President, Mr. A. E. Cunningworth; hon. treasurer, Mr. D. G. Brooks; hon. secretary, Mr. J. M. Dunkley; hon. social secretary, Mr. F. W. Martin.

LIVERPOOL ENGINEERING SOCIETY.—The annual dinner will be held at the Midland Adelphi Hotel, Liverpool, at 7 o'clock, on Thursday, February 4th. The Lord Mayor of Liverpool has accepted an invitation. Tickets (exclusive) will be twenty shillings each, and the dinner list will be closed on Saturday, January 30th.

Electrical Development.—In an interesting "talk" on this subject broadcast from the London station on Tuesday evening, Mr. D. N. Dunlop recalled that on a visit to an engineering works, Lord Kelvin once remarked to him: "I place no limit on the possibilities of the future; if man will only learn to be unselfish enough to be trusted with Nature's secrets." He proceeded to refer to the marvellous development of engineering since the time when James Watt occupied his little attic workshop, and declared that national progress depended more upon the use of electricity than on any other factor. In Watt's time men worked with their hands, and their horizon was restricted; now machinery did so much for them that few could realise what the world would be like without steam and electricity—such a city as London could not even exist. Power entered into every phase of their daily life—but they were not yet in a position to use electricity as freely as they should. The Government intended to introduce legislation to foster electrical development; all political parties were agreed as to its necessity, and such legislation, if effective, would confer countless benefits on the people, relieving them from drudgery and enabling them to develop those qualities which would make them a finer and nobler race.

Legal.—TELEPHONE MFG. CO., LTD., *v.* WM. SOUTTER & SONS, LTD.—Mr. Justice Greer, in the King's Bench Division on January 11th, heard an action by the Telephone Manufacturing Co., Ltd., against William Soutter & Sons, Ltd., of Birmingham, an action by the plaintiffs to recover from the defendants damages for alleged breach of warranty and misrepresentation.

Defendants counterclaimed for loss, which they alleged they had sustained through the cancellation of the agreement entered into between the parties in June, 1924, by which the plaintiffs were appointed the defendants' sole distributing agents for the sale of "Soutterware," a description of ironmongery manufactured by the defendants.

The plaintiffs' case was that the defendants represented that their sales amounted to some £30,000 per annum, upon the strength of which they spent large sums of money in advertising and getting the distributing organisation into working order, but that the defendants had dealt with the deliveries in such a way that orders were lost and plaintiffs were compelled to cancel the agreement. They accordingly asked for cancellation of the agreement and damages for the alleged neglect by the defendants to carry it out.

In the result, Mr. Justice Greer decided to send the case to an Official Referee, and made an order accordingly, the plaintiffs, through their counsel, agreeing that any charge of fraud they had originally made should be unreservedly withdrawn.

The Accident at Barking Power Station.—Referring to the accident which took place at the power station of the County of London Electric Supply Co., Ltd., at Creeksmouth, on December 14th, we have received the following particulars from the Company:—About 12 o'clock noon on Monday, December 14th, 1925, when the second line of a 40,000-kVA compound set was being run up, the cover of the governor valve was dislodged and fell through the floorplates on to the feed-pump gallery below, other pieces of metal of small section being at the same time scattered throughout the engine room in the vicinity of the turbine. Fortunately, the damage to the other equipment in the station was confined to the jamming of the governor gear on the other line of the same turbine, which was on load at the time. Three men (the driver, a pump attendant, and an employé of one of the contractors) received injuries, one of them having both legs fractured. The men were removed to the Poplar Hospital, and are reported to be making good progress towards recovery; in fact, two of them will, it is expected, be able to leave the hospital very soon.

The Company's supply was not interrupted, and the effect on the system was only slight, thanks to the Barking power house being interconnected with other generating stations.

The cause of the trouble has not so far been fully diagnosed, as, until the men concerned are fit to give evidence, those who are carrying out the investigations will be unable to arrive at any final conclusion.

From the foregoing it will be seen that the parts involved were of minor importance, and that the reports circulated in the first instance were exaggerated.

Electrical Association for Women.—The Association is arranging a musical afternoon at the Æolian Hall on January 23rd, when the application of electricity to the production of good music for the home will be fully demonstrated. Members and guests will be received at 3 p.m. by Mrs. Wilfred Ashley (vice-president of the Association), and later in the afternoon Mr. H. V. Spanner, Mus.Bac., F.R.C.O., a blind musician, will lecture on "The Place of Music in the Home."

The Economy of Railway Electrification.—The Interstate Commerce Committee is conducting an inquiry into the financial condition of the Chicago, Milwaukee and St. Paul Railway, and the *Electrical World* states that Mr. R. Beeuwkes, the company's electrical engineer, recently gave evidence showing that since electrical operation began, in 1916, up to the end of 1923 a saving of $12,400,000 had been effected. The total cost of electrification was less than $16,000,000. Mr. Beeuwkes estimated that it would take about two years to electrify the remaining 212 miles of the mountain section of the railway, if there were no interruptions. His opinion was that the company had been fully justified in the result of the electrification already carried out, and he believed that it would be profitable to convert the remaining stretch.

International Electrotechnical Commission.—The following important matters will come before the I.E.C. Advisory Committee at the meetings to be held in New York from April 13th to 22nd, 1926:—

1. Preparation of Part 2 of International Specification for Electrical Machines. (Large machines.)
2. General discussion on rating of electrical machinery, including presentation of papers by experts from various countries.
3. Preparation of a specification for traction motors.
4. Revision of the I.E.C. Publication 29—Hydraulics, including proposals for an International Specification for Hydraulic Turbines.
5. Preparation of an International Specification for Steam Turbines for driving Electrical Plant.
6. Completion of the list of International Graphical Symbols.
7. Preparation of an international basis for the testing of insulating oils.
8. Approval of the international standards for lamp caps and holders.
9. Confirmation of the list of international standard high pressures.
10. Preparation of international standards for high-pressure tests.
11. Preparation of an international code of rules and regulations for overhead lines.
12. Preparation of an international code of terminal markings.
13. Preparation of an international electrical vocabulary.
14. Some additional minor matters.

It will be seen that the questions under discussion at this meeting are of vital industrial interest to this country. Delegates will be present from all the principal countries, and information with regard to the meeting can be obtained from the Secretary of the British Electrotechnical Committee.

Women's Engineering Society.—A visit has been arranged for Monday, January 25th, to the Research Laboratories of the General Electric Co., Ltd., at Wembley. Those wishing to join the party should notify the secretary of the Society not later than January 20th. On February 12th Miss E. M. Kennedy will lecture on "Some Problems of the Machinery Market," and on March 12th Mrs. G. Shaw Scott, B.Sc., will lecture on "Women's Contribution to Metallurgy."

Tramway Equipment for New Zealand.—We learn from our New Zealand correspondent that new machinery is now on its way from England to that country for the Thorndon and Karori tramway sub-stations. It consists of automatic supervisory gear which will enable the whole of the plant to be controlled by an operator at the main station by means of an instrument of the automatic telephone type. This plant was described in the ELECTRICAL REVIEW for October 16th, 1925, page 621.

Institution Notes.

Institute of Metals.—The Institute increased its membership last year from 1,571 to 1,692. Such progress at a time of acute depression in the engineering and metal trades indicates that manufacturers are anxious to avail themselves of the latest scientific knowledge of metals with a view to meeting foreign competition. A ballot for the election of members and student members will take place on February 24th. Persons elected will be entitled to membership advantages for the extended period ending June 30th, 1927. Particulars of these advantages, and membership application forms, can be obtained from the secretary.

Institution of Heating and Ventilating Engineers (Inc.).—At a meeting held on January 6th, a paper was read on heating with hot water by Mr. J. R. Preston, who said that systems dispensing with mechanical power had in this country given way to electrically- or steam-driven pumps, largely because of the almost universal supply of electricity.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. FRANK GILL, M.Inst.C.E., M.I.E.E., has found it necessary, owing to an important engagement abroad, to resign his position as President of the National Association of Supervising Electricians. This decision is widely regretted, but the Association has been fortunate in securing as President Mr. A. M. Sillar, M.Inst.C.E., M.I.E.E., M.I.Mech.E. Mr. Sillar was formally introduced to the members at a meeting on January 5th, held at the Junior Institution of Engineers, 39, Victoria Street, London, S.W.1, by Mr. A. H. Dykes, M.Inst.C.E., M.I.E.E., a past President of the N.A.S.E. He will give his presidential address on the opening of the new session in October next. An account of the career of Mr. Sillar was published, together with his photograph, in the ELECTRICAL REVIEW for December 15th, 1922, in connection with his presidency of the Association of Consulting Engineers.

The *Daily Chronicle* states that Mr. N. ASHBRIDGE, B.Sc., A.M.Inst.C.E., has been appointed assistant-chief-engineer of the B.B.C. During the war he served with the Royal Engineers in France, and afterwards joined the Marconi Company as head of the Writtle experimental section, which he took over from Captain Eckersley when the latter joined the B.B.C. in 1923.

Dumfries Town Council has appointed Mr. W. ERSKINE as electrician for the ensuing year.

Kendal Town Council has increased the salary of the electrical engineer and manager by £44 to £450 per annum.

Subject to the proviso that no increase be granted to any official whose salary was advanced last year unless he has been promoted or has undertaken additional official responsibilities or duties, Manchester Corporation has accepted the following recommendation:—Traffic superintendent, tramway department, £981 to £1,000; permanent way engineer, superintendent, stores superintendent, parcels superintendent, chief claims clerk, carworks department, all of the tramway department, each from £703 to £750.

On January 6th the Liverpool City Council approved the appointment of Mr. H. A. W. WILLIAMS as turbine house superintendent in the electricity supply department at a salary of £425 per annum.

Beckenham Urban Council has decided to increase the salary of the electrical engineer and manager from £600 plus bonus, to £850 per annum, rising by annual increments of £25 to £1,000, as from April 1st, 1925.

In connection with the taking over of the local electricity undertaking by the Dalkeith Town Council, Mr. H. SMITH, at present employed at the station, has been appointed resident engineer at £286 per annum.

SIR GEOFFREY CLARKE, C.S.I., has been appointed to the board of the Telegraph Construction & Maintenance Co., Ltd., in the place of Mr. F. J. Lucas, who recently retired. He will act as joint managing director.

SIR A. HENRY MCMAHON, G.C.M.G., &c., has accepted a seat on the board of the Oriental Telephone & Electric Co., Ltd., and will take the chairmanship, in place of the late Sir George S. Gibb.

The *Board of Trade Journal* announces that, owing to ill-health, Mr. W. G. WICKHAM, Senior Trade Commissioner in South Africa, is relinquishing his position. Mr. N. ELMSLIE, Trade Commissioner in New Zealand, has taken up duty at Johannesburg pending the appointment of a successor to Mr. Wickham.

Science reports that DR. HARRIS J. RYAN, professor of electrical engineering at Stanford University, has been awarded the Edison Medal for the year 1925 by the Edison Medal Committee of the American Institute of Electrical Engineers "for his contributions to the science and the art of high-tension transmission of power."

On Friday last the Lancashire and Cheshire Tramways Authorities Council presented a grandfather clock and a trio of silver bon-bon dishes to Mr. JOHN BARNARD, M.B.E., the Bolton manager, to commemorate his silver wedding, and in recognition of his services as hon. secretary to the Council since its establishment.

Obituary.—MR. CONRAD W. COOKE.—We regret to record that Mr. Conrad William Cooke, M.I.E.E., passed away at Hampstead on Sunday last in his 83rd year. The deceased gentleman was for many years prominent in the consulting and electrical engineering world, but in recent times his activities did not bring him into such close touch with electrical affairs and those connected with them. It is by the older generation that he will be especially remembered, for it was just over fifty years ago (1872), after coming to London and entering into the partnership Whieldon & Cooke, engineers, of Lambeth, that, according to the published records, he introduced and made the first dynamo-electric machine (Gramme), and designed and installed the first electric light on the Clock Tower of the Houses of Parliament, which is stated to have been the first searchlight. He was joint author with the late Mr. James Dredge, of the celebrated work "Illuminating Engineering," and he was a regular contributor to the pages of our contemporary *Engineering* on electrical and physical subjects. He was very closely interested in the introduction of the incandescent mantle system of gas lighting. Mr. Conrad Cooke reported for *Engineering* the proceedings of the British Association at Glasgow in 1876, when Lord Kelvin described the invention of the telephone. He lectured at the Society of Arts in 1879 and gave them the first account of the Edison loud-speaking receiver. He was a witness for the defendants in the telephone case at Edinburgh, when it was first explained that the tilted diaphragm to the iron box receiver illustrated by him in *Engineering* and since incorporated in most text books, though accurate as regards the instrument shown by Lord Kelvin, was not in accordance with the design of the inventor. He also appeared as an expert witness in later cases, but took no active part in the development of telephony. As an expert witness in electrical and other technical cases in the Courts, his services were in frequent demand, while he was also a member of the Juries of many International Exhibitions. His numerous interesting additions to literature included a memoir of Gilbert of Colchester, and together with the late Prof. S. P. Thompson, he founded the Gilbert Club in the year 1889. The funeral service took place at Hampstead Parish Church on Wednesday, followed by cremation at Golders Green.

MR. C. G. DAY.—The death took place on January 2nd, of Mr. Colin George Day, who had for 17 years been secretary of Messrs. Mirrlees, Bickerton & Day, Ltd., of Stockport, of which his brother, Mr. Charles Day, is the managing director. He was 61 years of age.

MR. J. A. BRINELL.—The death recently occurred in Stockholm, at the age of 76 years, of Mr. J. A. Brinell, whose name was known throughout the world in connection with his ball hardness-testing machine. He also took a prominent part in metallurgical development in Sweden.

Will.—The late Mr. A. W. GATTIE left £1,208.

New Companies Registered.

Ormond Engineering Co., Ltd. (210,790).—Private company. Registered December 31st. Capital, £25,000 in £1 shares. Objects:—To adopt an agreement with E. J. L. Defosse, and to carry on the business of screw manufacturers and manufacturers of wireless components and accessories formerly carried on by the vendor as the Ormond Engineering Co. at 203, Pentonville Road, and 36, Whiskin Street, London. The directors are:—E. J. L. Defosse, 266, Green Lanes, Stoke Newington, N., engineer (permanent governing director and chairman); O. H. Delfosse, 21, Queen's Court, Wembley Park, engineer; Evelyn H. L. Townsend, 16, Claremont Square, Clerkenwell, secretary. Qualification, £100. Remuneration (except governing director) as fixed by the company. Registered office: 3, Throgmorton Avenue, E.C.

Bowden & Higlett, Ltd. (210,922).—Private company. Registered January 6th. Capital, £3,000 in £1 shares. To acquire the business of electricians and electrical engineers and mechanics carried on in Guildford as Bowden and Higlett, recently purchased by R. H. Tribe. The permanent directors are:—R. H. Tribe, Highfields, Nightingale Road, Guildford, builder; C. G. Howard, Kingsby, Bray Road, Guildford, electrician (managing director). Qualification, £50. Remuneration as fixed by the company. Solicitors: Smallpiece & Merriman, Guildford.

Official Returns of Electrical Companies.

Victoria Electrical (Manchester), Ltd.—R. N. Brookes, C.A., of 6, Princess Street, Manchester, was appointed receiver on December 28th, 1925, under powers contained in debenture dated January 28th, 1922.

Medway's Safety Lift Co., Ltd.—Second debenture dated December 22nd, 1925, to secure all moneys due and to become due not exceeding £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—J. and E. Hall, Ltd., 16, St. Swithins Lane, E.C.4.

Charles Fitz-Hugh, Ltd.—Particulars filed of £500 debentures authorised December 23rd, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

C. & J. Arrigoni & Co., Ltd.—Particulars filed of £100 debentures authorised December 4th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the extent of £6,976 on December 22nd, 1925, of debenture stock covered by trust deed dated June 28th, 1905, and a supplemental deed of acknowledgment dated June 12th, 1907, securing £200,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

International Automatic Telephone Co., Ltd.

An extraordinary general meeting was held on January 5th, when the proposals outlined in our issue of December 11th (p. 946) were considered. Sir Alexander Roger (chairman), who presided, said that the proposals marked an important stage in the company's progress. The telephone field was engaging the attention of new interests, and fresh efforts were being made all over the world to accelerate the development of the telephone. In order for the company to keep abreast of its responsibilities and opportunities it was necessary to raise fresh capital. The association of the company and the Automatic Telephone Mfg. Co. had resulted in a period of marked prosperity for them both; this association was made possible by the co-operation and assistance of Messrs. Theodore Gary and Co., who, as a consideration, were given an option to purchase 360,000 ordinary £1 shares of the company at 30s. each. The directors considered that the removal of this option would be in the interests of the shareholders. It was accordingly proposed that, in lieu of the option, Messrs. Gary & Co. should be offered, in the first instance, 360,000 of the 640,000 new ordinary shares which were to be created, at the price of 30s. per share. It was the intention of the board to issue in the near future shares, numbering probably 60,000 and not exceeding 140,000, in connection with certain trade investments already arranged or being negotiated. It was also necessary to alter the articles of association. The chairman then formally moved the resolutions; they were seconded by Mr. D. Sinclair, vice-chairman, and unanimously adopted. At a subsequent meeting of ordinary shareholders the resolutions were sanctioned and assent was given to the variation of their rights.

Vickers, Ltd.

The resolutions passed at the meeting held on December 17th (*vide* ELECTRICAL REVIEW, December 18th, p. 989, and December 25th, p. 1026) came before an extraordinary meeting on January 5th for confirmation. Mr. Douglas Vickers (chairman) presided, and said that the following shareholders had been invited to confer with the company's advisers:—Mr. Albert, senior managing director of George Senior & Sons, Sheffield; Mr. C. E. Siddall, chairman and managing director of the Sheffield Forge & Rolling Mills Co.; and Sir John F. Beale, a director of Guest, Keen and Nettlefolds, Ltd., and other companies. The resolutions were then formally moved. These, it will be remembered, provided for the reduction of the ordinary capital, the reorganisation of the board, the formation of three separate management boards, the winding-up of unremunerative subsidiaries, &c.

A shareholder endeavoured to move a resolution declining to sanction the proposed reduction of capital and appointing a committee of investigation to examine the financial transactions of the company. He was, however, ruled out of order and the original resolutions were confirmed by a large majority.

Electrolytic Zinc Co. of Australasia, Ltd.—A dividend at the rate of 12 per cent. has been declared on the preference and ordinary shares in respect of the half-year ended December 31st last.

The annual meeting was held at Melbourne on October 27th, when Mr. W. L. Baillieu, the chairman, said that apart from the zinc industry the company had been able to satisfy all the demands made upon it for superphosphate. This product was of a high uniform standard and the business was rapidly expanding. The directors had been able to increase the dividend and the financial position was such that there was every prospect of maintaining the rate.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 159:—

Crittall Manufacturing Co.—22,535 ordinary shares of £1 each, fully paid, Nos. 427,466 to 450,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Montreal Tramways Co.—$17,826,500 series "A" 30-year 5 per cent. general and refunding mortgage sinking fund gold bonds, Nos. M1 to M8,599 and M8,601 to M15,902 ($1,000), D1 to D2,750 ($500), and C1 to C5,505 ($100).

Chili Telephone Co., Ltd.—An interim dividend of 3s. per share, free of tax, has been declared.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are once more unsettled by the apprehension of a possible rise in the Bank Rate. So many millions of money have been required during the past few weeks for the purposes of new issue flotations that it has been fairly apparent to many people that the drain of money could not go on indefinitely without the money market being affected sooner or later. A great deal of the capital required during the past couple of months has been for interests outside the United Kingdom; British money has flowed into foreign loans raised without any proviso that the cash, or part of it, should be employed in this country for the encouragement of trade.

In these columns we have suggested that there is plenty of scope for employment of considerable sums of money in the various branches connected with electrical work, railway power, equipment, &c., and that the investment of British money in bonds and shares of American utility companies is a policy which has disadvantages from the patriotic point of view. Since the embargo was removed by the Government from the issue of foreign loans in this country, there has been a not unnatural scramble on the part of promoters to raise as much money as possible through the foreign issues which are so readily absorbed by British investors. The experience of the past few days is alone sufficient to emphasise the readiness with which the British investor subscribes to any stocks, foreign or otherwise, that appear to him to be cheap.

The electricity supply market is firm, with rises in several of the London shares. Kensingtons are ¼ better at 13¼, St. James's have hardened to 15⅛, and Westminsters are 2s. up at 2¼. Charing Cross strengthened to 49s. 6d.; Chelseas to 2 3/16. Countys are once more over £3. Deduction of the dividends from prices of several of the preference shares is being recovered, and the market is firm throughout. The warning is raised in several quarters against shareholders expecting too much from their boards of directors in regard to forthcoming dividends. Some of the financial guides maintain that prices in this section are already too high, as compared with those that rule for other sound industrials. Certainly the existing level of shares in home electricity supply companies offers temptation to those who recognise the discretion of taking a good profit upon the original purchase prices, but, in spite of this, the outlook is sufficiently promising to justify proprietors in keeping at any rate the greater part of their shares, though they may elect to sell a proportion in order to lessen the cost of the remainder.

The Home Railway market has been better, and the Undergrounds hold their improvements, although the stocks of the steam companies show a tendency to dwindle. The strength of the market is ascribed to dividend anticipations that, at the moment, are rather more optimistic than they have been of late. Underground "A" shares rose to 7s. 6d. Metropolitans and Districts are both better.

International Telephones are a strong market at 45s. Since the re-arrangement of the company's agreement with the American firm of Messrs. T. Gary & Co., the price of Internationals has gone sharply ahead. Automatics are 2s. 6d. up at 53s. 9d. Marconis have developed a firmer tendency, and the price of the parent shares is 1/16 better, at 26s. 3d. Marines are unchanged at 17s. 6d. Cable stocks exhibit little change.

Manufacturing shares are unusually quiet. The reaction in the price of raw rubber is deemed to be a bull point for the companies that use large quantities of the produce, but, in view of the likelihood of recovery in Mincing Lane, the investor in "equipment" shares prefers to go slowly as regards fresh purchases. Edison 5 per cent. debenture is quoted at 83 ex dividend, a price at which the yield on the money comes, once again, to a shade over 6 per cent. General Electrics remain at 29s. 3d. Babcock & Wilcox have strengthened to 51s. 3d. bid. The iron and steel market, with that for engineering shares, shows a disposition to improve: the argument is that prices can hardly be expected to go much lower than the existing range, and this suggests, of course, an expectation of recovery.

While Mexico Tramways fives have risen a point, Mexican Light & Power Firsts are again 1½ down. Brazilian Tractions put on a modest fraction; British Columbia deferred has regained the dividend taken off the price last week. Business in rubber shares has dwindled very appreciably, and the Stock Exchange as a whole is inclined to blame the Bank Rate uncertainty as being the cause for the quietude of trade that prevails in most of the markets round the House.

Share List of Electrical Companies.

	Nom.	Dividend. 1923.	Dividend. 1924.	Price Jan. 11 1926.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	12	14	29/6	—	4 14 1
Brompton Ordinary	1	10	10	11½	—	*5 18 6
Charing Cross Ordinary	1	14½	15	49/6	+9d.	6 1 3
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2⅞	+1/3	5 9 9
City of London	1	15	15	50/9	—	5 18 1
do. do. 6% Pref.	1	6	6	20/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	60.9	+1/3	4 18 9
do. do. 6% Pref.	1	6	6	22/-xd	+6d.	5 9 1
Edmundson's Ordinary	1	7	7	24/6	—	5 14 8
do. 7% Pref.	1	6	7	21/6xd	+6d.	6 10 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	13½	+¼	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	10	33/6	—	5 19 5
do. do. 6% Pref.	5	6	6	5⅝	—	5 7 10
Metropolitan	1	10	11	40/6	—	5 8 7
do. 4½% Pref.	1	4½	4½	17/6xd	+6d.	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	22/6	—	6 4 6
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½xd	+¼	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	-	5 6 8
St. James' and Pall Mall	5	17½	17½	15⅝	+⅛	5 12 0
South London	1	15	15	2⅜	—	5 18 1
South Metropolitan Pref.	1	7	7	1¼	—	5 12 8
Urban Ordinary	1	4	4	18/8	—	4 7 8
do. 6% Pref.	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	2¼	+2/-	6 0 0
Whitehall Elec. Invest. 7½% Pref.	1	7½	7½	19/6	—	7 13 10
Yorkshire Elec.	1	8	8	30/6	—	5 5 0
HOME RAILS.						
Central London Ord. Assented Stock	£	4	4	68	—	5 17 8
Metropolitan	"	4	5	69½	+½	7 3 11
do. District	"	3½	3½	48½	+1	7 4 4
Underground Electric Ordinary	10	Nil	Nil	2⅜	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	7.6	+6d.	Nil
do. do. Income Bonds	£	6	6	98	—	*6 2 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. Stock	£	6	6	108	—	5 16 6
do. Def.	"	1½	1½	25	+½	6 0 0
Automatic Telephone	1	5	6	53/9	+2/6	2 4 10
Chili Telephone	£	6	6	6⅞	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6⅞	—	7 8 5
Eastern Extension	10	10	10	17⅞xd	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½xd	+½	*5 14 0
Globe Tel. and T. Ord.	10	10	10	18½	-½	*5 8 1
do. do. Pref.	10	6	6	11	—	5 9 4
Great Northern Tel.	10	22	22	33	—	6 13 4
Indo-European	£5	7	8½	45½	—	*4 13 5
Marconi	10	10	10	1⅞	+1/3	7 12 4
Marconi Marine	1	10	7½	⅞	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/6	—	*5 12 11
United R. Plate Tel.	£	8	8	7½	—	5 2 5
Western Telegraph	10	10	10	18	—	*5 11 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£	5½	6½	8½	—	8 9 2
do. do. 2nd Pref.	£	6	6	8⅞	—	9 8 2
do. do. 5% Deb. Stock	£	5	5	73½	—	6 16 3
British Electric Traction Ord.	"	6	6	119½	—	5 0 0
do. do. 5% Pref.	"	5	5	105	—	5 14 3
Brazil Traction	100	4	4	88½	+¼	4 13 7
Brit. Columbia Elec. Ry. Pcs. Stock	£	5	5	89½xd	—	5 19 9
do. do. Preferred	"	9⅚/-	9⅚/-	102½xd	—	*4 12 8
do. do. Deferred	"	129/5	129/5	127xd	+2½	*5 2 4
do. do. Deb.	"	4½	4½	77	—	5 10 5
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	8/6	—	Nil
London United Tram. Deb. Stock	£	4	4	40½xd	—	9 17 6
Mexico Trams, 5% Bonds	—	£	£	62½	+1	8 0 0
Mexican Light Common	100	Nil	Nil	8½	—	Nil
do. Pref.	100	Nil	Nil	6½	—	Nil
do. 1st Bonds	—	£	£	69	-1½	7 4 11
Yorkshire (West Riding)	1	£	—	18/9	—	5 6 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	51/3	—	*4 13 4
British Aluminium Ord.	1	5	10	38/-	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	1	—	
British Insulated Ord.	1	15	15	2½	—	5 6 3
Brush Ord.	1	10	10	2⅜/-	—	7 2 10
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref.	1	6½	6½	23/9xd	+6xd.	5 9 5
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	9/3	—	4 6 6
do. 5% Deb. Stock	£	5	5	83xd	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	11xd	+6d.	6 0 0
English Electric	1	5	5	19/3	—	5 3 11
do. do. Pref.	1	6	6	20.6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	5	7½	29/3	—	5 2 7
Henley	1	15	15	3½	—	4 11 5
do. 4½% Pref.	£	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅞	—	*4 14 1
Johnson & Phillips	1	10	10	56/3	—	3 11 1
Met-Vickers, Ord.	1	8	8	27/-	—	5 18 6
do. Pref.	£	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	33/-	—	4 5 9
Telegraph Construction	12	20	20	27	—	*4 9 0

*Dividends paid free of Income Tax.

A Hospital Radio Installation.

A Large Igranic Receiving Outfit at the London Hospital.

IN connection with the equipment of hospitals in this country with broadcast radio receiving apparatus, under the *Daily News* scheme, for the entertainment of both patients and staff, the installation recently completed at the London Hospital is worthy of notice. As the hospital is the largest in the United Kingdom, a set of unusually large size had to be provided, it being capable of serving 1,000 listeners at different points.

The receiving apparatus, which has been designed and presented by the Igranic Electric Co., Ltd., is housed in an asbestos-lined hut on the roof of the institution. It employs 16 valves and is operated through the agency of relay mechanism

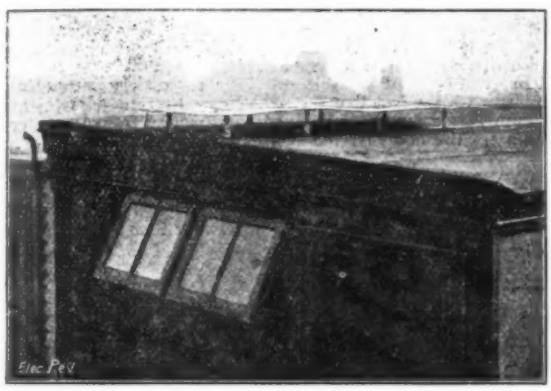


Fig. 1.—Plate Aerial on Roof.

controlled by a tumbler switch in the porter's lodge. The various wards have been wired into nine distinct circuits, eight of which supply 842 pairs of headpieces, whilst the ninth actuates a series of loud-speakers in the children's wards.

The Receiver.—As indicated in fig. 1, a sheet of metal fixed to the roof of the hut serves as the aerial for an Igranic 6-valve super-heterodyne receiver (illustrated in fig. 2, with the glass covers removed), the wiring arrangement of which is similar in essentials to that of the standard model. By employing various combinations of terminals it is possible to use a variety of signal input circuits. Thus, either the recently developed twin-winding frame aerial, or a simple frame, may be used directly coupled or else *viâ* the intermediary of a two-circuit tuner. Alternatively, any form of open aerial may be used, either directly or variably coupled, as before. The comprehensive nature of these arrangements facilitates the treatment of any regional interference on the lines best suited to its elimination.

The initial valve (an Osram DH5, working at 60 volts) functions in the dual capacity of oscillator and rectifier, a capacitative balancing system permitting the signal-frequency and oscillator-frequency circuits to be worked without mutual interference. The use of this system not only dispenses with one valve, but also restricts the amount of locally-generated energy passed into the aerial circuit, so reducing the possibility of radiation to negligible terms.

This valve communicates with three stages of intermediate-frequency amplification, each of which employs a form of reactance-capacity coupling adjusted to a wave-length of some 6,000 metres. This wave-length would seem to be the most satisfactory choice when it is intended, as in this case, to effect reception from stations using waves up to 2,000 metres in length, for it implies a desirably substantial frequency difference between the two channels of signal acceptance, whilst the copper losses remain low and the unwanted electrostatic couplings are of high reactance.

Great importance attaches to the resonance curve of the intermediate-frequency amplifier, for it is said that in no other practical receiving system is there the same opportunity of maintaining the most satisfactory selective condition throughout the entire range of received signal wave-lengths.

In the instrument under review it has proved possible by proportioning the l.c. ratios and damping factors to effect a form of band filter which cuts off sharply at the outer limits of the useful sidebands emanating from the transmitter. This is the condition of maximum selectivity consistent with faithful telephony. The characteristics of the band filter are, of course, entirely independent of the signal frequency and remain unaffected by any change of signal wave-length, since the frequency at which amplification is conducted remains constant.

As the result of an extinction of limiting couplings between the intermediate-frequency stages, the designers have been able to cascade three Osram DE5B valves, working at 120 volts, and to employ their high M value to the maximum in each stage without instability or resorting to the deliberate introduction of losses as a means of suppressing undesirable oscillation. Indeed, so stable is the amplifier claimed to be that it has been possible to impart to the grids of the intermediate-frequency valves a negative bias of 1½ volts in order that no grid current shall flow and so encourage premature rectification and consequent distortion.

A novel arrangement is used to apply reaction to the amplifier when desired; the potential gradient between the grids of the first and second amplifying valves is controlled by means of a variable non-inductive resistance having a maximum value of one megohm. The third intermediate-frequency stage delivers to the final rectifier (an Osram DE5B working at 120 volts) the grid of which is maintained at a positive potential so as to stimulate the flow of grid current that is essential for cumulative rectification.

The single stage of note amplification of the super-het receiver is not included in the hospital set, since the latter is attached to a special power bank amplifier as shown in fig. 2.

Although, by virtue of the very high amplification available, the plate aerial proves effective for full-load reception from a number of stations, higher selectivity and responsiveness are obtainable when the patent frame aerial is employed. The latter is collapsible for portability and performs an interesting secondary function, for it eliminates interference set up by stations using wave-lengths in, or near, the band to which the intermediate-frequency amplifier is responsive. It embodies two geometrically parallel windings consisting of an equal number of turns, one winding being tuned to the signal frequency by means of a condenser in the receiver, while the other is wound in the opposite sense and not tuned. The two windings are so arranged in the receiver circuit that the arrival upon the frame of a widely non-resonant frequency results in the simultaneous formation of two potentials of equal voltage and opposite sign, a condition producing mutual cancellation and elimination of the long-wave interference to which super-heterodyne sets working on directly-coupled frame aerials have always been subject. On the other hand, when dealing with resonant frequencies the responsiveness of the tuned winding rises to a maximum, while that of the untuned winding remains low; hence there are no opposing effects and reception from desired stations is therefore in no way effected.

The Power Bank Amplifier and Distribution Scheme.—In the power bank amplifier the secondary winding of the input trans-

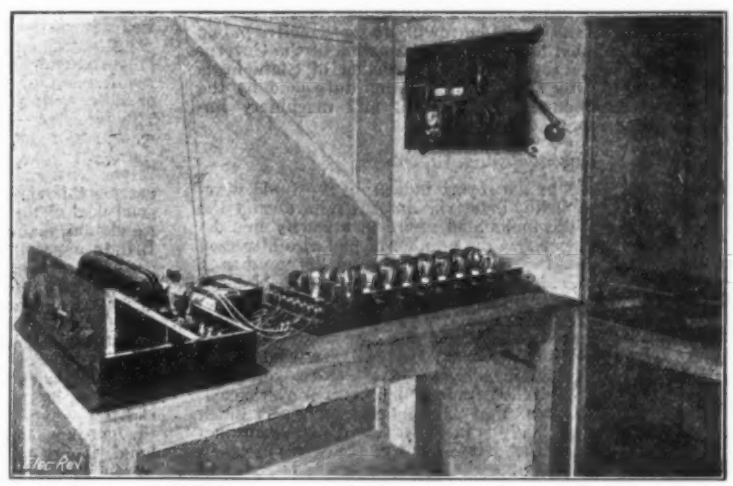


Fig. 2.—Super-heterodyne Receiver and Power Amplifier.

former is common to nine valves; the anode circuit of eight of them contains an output transformer, the secondary winding of which is earthed at its centre point in order to maintain the output leads at balanced potentials. The impedance of the various output circuits has been approximately equalised and it is such that, considered in relation to the anode impedance of the Osram LS5 valves, 7 to 1 step-down transformers were designed. Since the capacity of the line is reflected across the primary winding of its associated transformer inversely as the square of the ratio of transformation, it may be as high as 0.1 mfd. without seriously impairing the amplitude of the higher frequencies. This figure is not attained

at the London Hospital and even on the longest line there is no interference with the tonal balance.

The ninth valve delivers *via* an appropriate transformer to an Osram LS5A valve, the anode circuit of which is coupled through an output transformer to a number of Amplion loud speakers. An indication of the input voltage swings which are qualitatively permissible (and desirable to ensure a reasonable safety factor) is provided by the fact that a negative bias of 45 volts is imparted to the grid of each of the LS5 valves, while the grid of the LS5A valve is negatively biased to the extent of 120 volts. The anode current to all the valves in the power bank is supplied at a pressure of 300 volts.

The output lines are paired off and run in lead-covered cables, all the coverings being bonded and earthed to obviate induction effects. Each headphone circuit is sub-divided into four or five ward sub-circuits at appropriately placed junction boxes, and in the event of a local fault it is therefore possible to isolate any ward expeditiously without detriment to the main service. Some idea of the magnitude of the installation may be gauged by the fact that about 15 miles of lead-covered line had to be laid to carry the current from the radio hut to the bedside headphones and loud speakers in every part of the hospital.

Although primarily intended for reliable reception from the London and Daventry stations only, the plant is able to give a full-load service from a number of European broadcasting stations.

Batteries and Charging Mechanism.—The filaments of the receiver and power-bank valves require a total current of 10 amperes at 6 volts, while the combined anode requirements account for 150 milliamperes at 300 volts, a 3-ampere-hour accumulator providing the latter supply.

The batteries are housed in an isolated and separately ventilated section of the instrument hut. Practical considerations dictated the provision of two motor-generator sets for charging purposes and they are also installed in the battery compartment of the hut. No. 1 set has an output of 15 amperes at 10 volts, and No. 2 set delivers 0.3 ampere at 350 volts.

Since the apparatus has been designed to provide a possible 14-hour reception programme daily, it was necessary to adopt means of expeditiously conducting the charging operation; to this end the action of the motor generators is governed by Igranic automatic controllers. Directly the receiver is switched off, the controllers start the generators and the charging current, *inter alia*, drives a small mercury motor that communicates with an indicator which registers the extent to which the ampere-hour capacity of the batteries is satisfied. When the indicator is driven to the position denoting a complete charge, a relay is tripped and the charging circuits are broken. If the receiver should be switched on during the charging process, the generators will automatically stop and resume their task when the receiver is switched off.

The employment of this mechanical battery attendant, coupled with the fact that the two essential tuning adjustments of the receiver are normally fixed for reception from Daventry, eliminates the necessity for skilled attention.

Australian Trade and Industry.

The Growth of Home Production.

A REPORT upon the economic and commercial situation of Australia has been forwarded to the Department of Overseas Trade by Mr. R. W. Dalton, Senior Trade Commissioner in the Commonwealth.*

In his opening remarks Mr. Dalton says that in general conditions in Australia during the past 12 months (*i.e.*, to June, 1925), were very favourable and production was at a high level. Mention is made of the gradual drift of the small population of Australia to the large cities, and it is said that the development of manufacturing industries by a system of high protection has intensified this drift, and will probably continue to do so. This aspect of Australia's life is not without considerable interest and importance from an economic point of view, and it is also one which must be taken into account in the consideration of commercial organisations for the development of trade. In the early part of the year 1924-25 the financing of industry and shipment was attended by considerable difficulty; the position later improved and is now much easier. Regarding the general financial condition of the Commonwealth, Mr. Dalton states that at the last annual conference of the Associated Chambers of Commerce, a resolution was passed emphasising the paramount importance of the restriction of expenditure and public borrowing to reproductive public works. The resolution also deplored the action of the Government in treating as revenue that proportion of State loans which represented the amount of Customs duty paid by the State to the Commonwealth, on plant and machinery imported for State use.

Manufacturing Industries.

Statistics are given in the report indicating the rapid development of manufacturing industries in Australia during the last few years, and the undoubted desire to intensify this development. It is shown that the number of factories increased from 18,023 in 1921-22 to 20,189 in 1923-24, and the number of hands employed from 395,425 to 429,990. The value of plant and machinery increased from £78,085,680 in 1921-22 to £99,552,539 in 1923-24. Mr. Dalton says that Australian industries on the whole are advancing in the satisfaction of home demand. The output of Australian factories per head of the population is very much in excess of the imports per head. This is a feature of Australian trade which is often overlooked, the belief being widespread that the import trade is very much more serious than it actually is in competition with Australian industries. A more or less detailed list of the various classes of industry appears in the report, from which it is gathered that the number of factories producing metalwork, machinery, &c., in 1922-23 was 2,349, with a total output value of £51,038,984. In another section, "Heat, light and power," the number of works is given as 590 and the total value of output £13,467,604. Apart from industries in connection with the production of food and drink, by far the most important industries in Australia are those connected with the manufacture of goods from metals and textiles. There has been a rapid development in these in the last few years; as regards the former, particularly in iron and steel. It has been maintained by these industries that they have to face very severe competition from imported goods, and they have made persistent requests for increased protection, which is likely to be accorded them. Considerable added protection has already been given them, particularly by the tightening up of the regulations with regard to the percentage of British labour required to qualify for preference and by the application of the Industries Preservation Act. A number of branch factories of British firms have been established in Australia, and during the past year many representatives of other British firms have visited the country in order to ascertain what possibilities of success might attend the establishment of additional factories. In some outstanding cases, the establishment of such factories has not been successful—sometimes due to over-capitalisation, high production costs, uncertainty of labour conditions, and lack of demand. It will soon be necessary, even if it is not now necessary, for Australian industries in certain sections to find an export outlet for their goods.

Tariff Questions.

Most of the secondary industries of Australia have made persistent demands during the past year for increased tariff protection, and the Tariff Board which was made permanent by Act of Parliament during the last session, has been busy throughout the year hearing applications in connection with a large number of classes of imports. During the year there was a great deal of complaint by Australian manufacturers regarding the importation of British goods containing a large proportion of foreign material, and it was contended that the requirement of only 25 per cent. British labour or material, or both, to qualify for British preference, was much too small. The Minister of Customs therefore decided to alter the basis on which preference was given, and it was at first thought that the new regulation would make the requirement for preference 75 per cent. British labour, or material, or both, but after discussion this view was modified. There has been, and still is, a good deal of misconception as to the requirements of the new regulation, many importers in Australia and exporters in Great Britain appearing to believe that there is an all-round 75 per cent. requirement. This is not the case. If no process of manufacture has been carried out abroad which could be carried out in the United Kingdom there is no specification of the percentage of British labour or material required to qualify for preference. That is, supposing that in £100 value of goods shipped no labour was applied to the goods abroad which could have been applied in the United Kingdom, as much as £99 might represent foreign raw material if the remaining £1 represented British labour, and still the goods would be admitted for preference. On the other hand, if any process of manufacture were carried out abroad which was commercially practicable in the United Kingdom, then if the goods were of a class made in Australia, 75 per cent. United Kingdom labour or raw material, or both, would be required to qualify for preference; thus, if in £100 value of goods 6d. represented labour carried out abroad which could have been carried out in the United Kingdom, £75 at least would have to represent United Kingdom labour or material before the goods would be admitted to preference. In cases of goods of a class or kind not made in Australia, in which foreign processes have been applied which are commercially practicable in the United Kingdom, the old "25 per cent. United Kingdom labour or material, or both" requirement still obtains.

Electrical Machinery Imports.

The report states that the total imports of machines and machinery into Australia in the year 1923-24 were valued at £12,716,184, as compared with £10,963,874 in the preceding

* Stationery Office. 2s. net.

year. No separate total for electrical machinery is given, but the chief sections of the electrical trade are set out. It is shown that the two most important items were cables and wires of all kinds, amounting in value to £1,274,274, of which the United Kingdom supplied £1,240,088; and dynamo-electric machinery valued at £990,351, the United Kingdom's share being £613,153 and that of the United States £271,041. Complete lists of Australian electrical imports in the years 1922-23 and 1923-24 appeared in our issue of July 10th, 1925 (page 76).

Trading Methods.

Although the population of Australia is only about 6 millions, the Commonwealth is Great Britain's second largest export market—a fact that should be sufficient to attract the attention of firms in the United Kingdom and to lead them to look more closely into the possibility of development of this very valuable market. Close study of the market is necessary, for the difficulties of organisation facing any firm which sets out to extract the maximum amount of business from the Commonwealth can only be realised after first-hand investigation. The placing of agencies requires most careful consideration and appreciation of the differences between the various States. There are some well-known firms of agents which have their own branches throughout Australia, and with which agencies may safely be placed. These firms, however, are relatively few and are accordingly well supplied with agencies and are often unable to consider further offers. It is desirable, therefore, if not essential, to consider carefully the appointment of separate agents in each State. It is not sufficient merely to give an agency to a firm in Melbourne or Sydney for the whole of Australia merely because it asks for it, as the firm's organisation may be totally inadequate to cover the whole of the Commonwealth. Mr. Dalton says that many British firms of high repute have been seriously prejudiced in Australia by the appointment of agents who would never have been appointed had the exporting firms taken proper steps to understand the trading organisation of Australia, and to ascertain the standing and experience of the agent in question.

Magnetic Separation Plant.

By Col. B. I. ROLLING, D.S.O.

(Abstract of Paper read before the INSTITUTION OF CHEMICAL ENGINEERS.)

A GREAT variety of trades are interested in the possibilities of magnetic separation, but there is a paucity of literature on the subject. There are three uses for such separation :—

1. The concentration of weakly magnetic ores—high intensity separation.
2. Slag reduction and the reclaiming of unburnt coal.
3. Removal of iron content from scrap material or from flowing material, *e.g.*, grain, sugar, for refining clay, chemicals, &c.

Of modern mining processes for grading out a mass of material into classes according to the relative susceptibilities to intense magnetisation, one of the most effective under certain conditions is magnetic separation. Many valuable minerals contain iron, sometimes in minute quantities, but generally in a sufficient amount and in a form which permits them (in a raw or roasted condition) to be influenced by a magnet.

Wetherill's separator was originally designed for the handling of raw ore containing valuable, or very weakly magnetic, minerals; later it was adapted for the removal of roasted pyrites from zinc blende, &c., as its capacity on such highly magnetic material is very large and costs for power and labour extremely low. The dry material to be treated flows on to the feed roller, which spreads it in a thin uniform layer over the whole width of the conveyor belt, as it travels towards the poles of two horse-shoe electromagnets, arranged one above the other. The poles of the upper magnet are forged in the form of a sharp wedge, while the lower ones are flattened. The principle is characterised as "sharp against flat," and it is the high magnetic concentration on the upper pole caused by the converging field which enables the separator to treat very weakly magnetic material. The magnetic force of the upper wedge-shaped pole supersedes that of the lower, so that the magnetic particles are strongly attracted towards the upper pole, but are intercepted and prevented from reaching the upper pole by a cross-belt which removes them quickly from the field and allows them to drop into a receptacle at one side.

The removal of the magnetic particles is assisted by mounting a sharp piece of iron on the front part of each upper pole; by means of this horn the influence of the magnetic field on the particles being removed is gradually decreased. These separators may be constructed with one, two, or three double magnets giving two, four, or six poles, each double magnet having a rheostat for regulating the current strength. A take-off belt is provided for each pole, and a single feed conveyor belt for the entire machine.

This form of separator is durable and accessible, and when once adjusted to the requirements of a particular ore, it will operate continuously at a nominal cost for the renewal of wearing parts. The use of a series of magnets of different strengths permits the separation from one another of materials having different magnetic permeability, as well as the separation of the magnetic from the non-magnetic. The separate removal of the strongest as well as the very weakest magnetic minerals is thus obtainable. All ferrous ores, whether oxides, sulphides, or arsenical, are susceptible to magnetic concentration.

In the concentration of ores, consistent sizing plays a very important part. Ding magnetic separators extract by means of a revolving disk directly above the conveyor belt which carries the ore through the magnetic zones of the separator. The capacity of a magnetic separator is in direct inverse ratio to the mesh to which the ore is crushed. Another factor which determines the capacity of the separator is the reluctance of the mineral to magnetic flux. Pure iron furnishes the least resistance to magnetic flux and each impurity adds to the resistance offered to the flux passing through it. To extract iron filings from brass chips, for instance, requires only a weak magnetic field, but wolframite requires a separator in which the magnetic lines of force are concentrated upon knife edges that produce zones of magnetic flux which virtually saturate the gap between the poles through which the ore must pass.

It was customary, before high-intensity machines had been exploited sufficiently, to subject zinc ores to a substantial "sweet" roast in order to oxidise them thoroughly, thereby making the iron sulphides perceptibly magnetic, and in so doing making it possible to extract them by means of a medium-intensity machine. Great waste resulted because with high-intensity machines only a very light "skin roast" is required, and therefore not only is the final zinc content of the finished product raised, but the roasting costs are cut and the high percentage of sulphur in the iron sulphide permits of its being utilised for the manufacture of sulphuric acid.

In the zinc fields of South-Western Wisconsin, concentrating plant, which previous to the application of high-intensity magnetic separators had tailing piles averaging from 2 to 5 per cent. zinc, the loss has been reduced to less than ½ to 1 per cent. and the content of the finished ore has been raised from 57 to 63 per cent. Iron sulphides have found a ready market at acid plants and bring from 21s. to 35s. per ton. Formerly the latter was not only a direct loss but also required fuel to burn off the sulphur, and incidentally also encouraged lawsuits arising from the destruction of crops and vegetation in surrounding districts.

For separating slags containing iron from coke and other fuel residues, the wet process is cumbersome and of small efficiency; the plant is expensive, the working cost high, and valuable quantities of fuel are lost.

The greater part of the fuel residues which are no longer combustible possess magnetic properties; the fuels contain iron compounds to a small extent (*e.g.*, pyrites) which are converted in the fire to various oxides of iron and appear in the ashes and slag as silicates by fusion with SiO_2, and it is possible, by passing the ashes through a highly-concentrated magnetic field, to recover the coal as a non-magnetic product. This process can be carried out dry, whereby subsidiary plant, such as dehydrating apparatus, pumps and large settling tanks, are dispensed with, and only 1 kWh of d.c. energy is necessary to separate one ton of ashes. Even the finest material can be treated and the fuel contained therein easily recovered. Also it permits of the recovery of the coke and unburnt coal in an easy and cheap way from ash and slag wastes from industrial works, railways, shipping, and from refuse. Recovered fine particles of fuel can be made up into "briquettes" or directly fired as powdered fuel.

In view of the simplicity of the equipment, it is possible to build a profitable plant for a very small output, such as would not be possible in the case of a wet mechanical plant. The economic advantage of the magnetic process becomes much more apparent, however, when the greater yield of coke and unburnt coal is taken into consideration. When we realise the huge quantities of fuel residues produced annually in industry, traffic organisations and households, we perceive that the magnetic process is capable of bringing about great national economies. The most common application of magnetic separators is the separation of material of high magnetic susceptibility. Machines are liable to be damaged by the presence of iron or steel, in the form of nails, bolts and nuts, &c., which are also in many cases detrimental to the finished product. One of Messrs. Christy Brothers' machines, capable of extracting iron from materials such as cotton seed, destructor clinker, bones, &c., has a shaking tray which serves the double purpose of distributing the feed uniformly, and also causes the iron to sink to the bottom of the stream by gravity. It then rides over the slowly revolving magnetised cylinder, when the non-magnetic material falls down in front, and the iron is carried round past the bottom and falls at the back. The release is effected by two commutators, one at each

end, breaking the electric current which energises the magnet coils, just as each row passes the bottom; the commutators also connect each row as it passes the top, thus magnetising them again.

The stud feature is used by the Rapid Magnetting Machine Company. The belt is studded with conical "feelers" which become magnetic when passing over the drum, thereby increasing the magnetic field. "Igranic" magnetic separators are employed in a large number of sugar plants to remove iron rust or oxide from animal charcoal, a contamination produced while passing through the "char" burners, so that trouble with iron colouring in the sugar is prevented.

The use of powdered or pulverised fuel has led to the need of magnetic separators in cement works, steel works, power houses, and many other kinds of plant. A pulley made by the Igranic Electric Co. consists of a number of steel disks keyed to a shaft, an electromagnet winding being placed between alternate disks. The magnetising coils are wound on steel bobbins, which are dowelled to the disks to prevent shifting. The coils are all connected in series and terminal wires brought through a hole in the centre of the shaft to a pair of collector rings. The coils are impregnated with a moisture-repelling and insulating compound by the vacuum process, and the space surrounding them is filled with the same compound poured in the molten state during assembly. A tubular brass spacer, which also performs the function of a coil shield, is placed between the adjoining steel disks.

In designing such pulleys, it must be borne in mind that dimensions and weight are not the only features. Less copper and more steel secures a cheaper construction, while an abundance of copper may be spoiled by a lack of steel in the magnetic circuit. A small reduction, as from 100,000 to 90,000 lines per square inch, reduces the pull to 81 per cent. The windings, if placed near the shaft instead of near the outside of the pulley, will require much less copper, but the efficiency will be reduced on account of excessive leakages. Large diameter pulleys will, in every case, give better results than those of small diameter, and the wear and tear on the belt is less. Good practice allows 3 in. of diameter per ply; for example, 18 in. diameter for a 6-ply belt. Small diameter pulleys, however, have a lower first cost, and where a short belt is installed their use is permissible. Where conveyor flights are long, and especially where the magnetic pulley is a driving pulley for the conveying-belt system, it is frequently economical to use a large diameter narrow-face pulley because of the saving effected in the cost of a narrow belt.

For removing iron from metal turnings, dust, and similar materials containing a large percentage of iron, the feed tray is oscillated sidewise, and the delivery end is serrated to distribute a regular stream of material on to the whole width of the revolving brass drum, which has ridges at intervals across its width. Inside the drum are fixed electromagnets with alternate poles. The magnets radiate from the centre and occupy one half of the drum only, the other half being hollow, and the magnetic field extends round the front half of the drum. The iron is attracted to the surface of the drum and momentarily held there till one of the brass ridges pushes it out of the field of the magnet of, say, north polarity. The material then jumps to the next magnet, which will be a south pole, and this process is carried on till the last magnet has been passed, when the magnetic material falls. Whilst the iron is being pushed from one magnet to another it changes polarity and throws out any particles of brass which may be adhering, preventing waste and giving a clean product at the back. The process will successfully separate a mixture of 99 per cent. iron and 1 per cent. brass or copper, &c., turnings or filings.

A less expensive class of separator consists of a trough in the bottom of which are concealed electromagnets to attract the iron content. This type is limited in application and cannot be recommended for material containing more than 3 per cent. of iron.

Finally the liquid separator is used chiefly in art-tile and porcelain manufacture for the treatment of slip which passes up the annular space between the core and the non-magnetic tube. The magnetic substances are held against the grooved section of the pole pieces which serve to concentrate the flux across the air gap at these sections. The apparatus must be de-energised and flushed down for the removal of the magnetic material.

Considerable improvements have been made and patented in this country by Krupps, of Magdeburg, most being so designed that the material to be separated is acted on at several points simultaneously. Another device of Krupps relates to the wet magnetic separation of ores and other materials by the aid of drum separators of the kind in which the material is charged on to the upper part of a drum in contradistinction to those wet processes in which the magnetic separating surface is located above the feed conduit. At the same time there is formed on the separating surface a continuously renewed layer of water, the raw material being itself charged either dry or wet. The magnetic particles are attracted to the separating surface through the liquid layer, while the non-magnetic particles are held back by the surface tension, so that good separation is effected.

Krupps have also recently patented a system of multiple drums, by means of which the material withdrawn at one or more points of separation is fed on to the next point for repeated treatment. Another interesting separator by the same firm has pole plates so constructed that the individual fields formed by each two adjacent plates increase or decrease in the direction of the supply of the material. The plates can be adjusted axially for increasing or decreasing the field. The pole pieces can also be adjusted radially. An interesting type is made in this country by the Rapid Magnetting Co., and in America by Ding's Separator Co. It is used mostly for the treatment of refuse and the removal of tins, &c., and consists of a rotating screen and a curved magnet or magnets. The material is fed into the rotating screen, and the magnetic contents are held to the sides of the screen until they are just above a chute, at which point the magnetic circuit finishes, and the tins or other iron articles are dropped into the chute.

Discussion in London.

Mr. H. N. RIDGE referred to a magnetic separator which was used in New Jersey 26 years ago for treating zinc ores, which were dealt with at the rate of 1,000 tons per day. He also illustrated machines which he used in Australia in the nineties, and with which he had been able to produce zinc concentrates commercially from Broken Hill sulphide ore. Later, however, the plant had been scrapped, because the magnetic separation of the weakly magnetic ores had been superseded by flotation, except in isolated cases. Referring to a statement in the paper, that sulphide and carbonate zinc ores were roasted in order to oxidise the foreign sulphides associated with zinc, he did not think any plant was carrying out that operation to-day. Plant in operation to-day might appear to be very similar; the operation in that case, however, was not roasting, but calcination.

PROFESSOR J. W. HINCHLEY referred to the separation of leucite mineral, of which 55 per cent. consisted of a black gangue which was slightly magnetic. The gangue was not readily removable by the standard Wetherill magnetic separator, but when the lower magnet of that machine was removed, the material was handled perfectly. With the magnetic system usually adopted in the Wetherill machine, separation was a failure. He had seen the machine actually dealing with 1½ tons of total material per kilowatt-hour without the lower magnet, the upper magnet doing all the work.

Mr. W. M. MORDEY was not surprised to hear that the Wetherill machine had been able to deal with leucite quite well when the lower magnet was removed. The thing that impressed an electrical engineer when he began to study magnetic separation was that the inventors of machines knew very little about electricity, and less about magnetism; however, the inventors knew a very great deal, and obtained results which they would never have obtained if they had asked the advice of electrical people. In the Wetherill machine, both magnets attracted the material, and the action of the separator was a differential one. If the lower magnet were taken away it was possible that a better result would be obtained, because there would then be no differential action, but a flux would be set up which would enable the material to be lifted. Most of the ingenuity of inventors had been spent, not in attracting the material to be separated, but in getting it away from the magnets; the actual attraction was a comparatively small part of the problem. Hitherto only direct current had been used, but recently he had been experimenting with alternating current; by repelling material instead of attracting it, one got rid of the difficulty of having to remove the material from the poles, and a cleaner concentrate could be obtained. Mr. Mordey showed a number of slides to illustrate his work, and one of them showed how a magnet repelled specular hematite in the form of a halo a considerable distance from it, there being no signs of attraction or lines of force. The material was interesting; in books it was said to be non-magnetic, but it always occurred in nature, he believed, associated with a little magnetite, and if that magnetite were removed by an ordinary magnet a residue of specular hematite was left, which was not attracted by an ordinary magnet, or even by a strong electromagnet. The only means by which he had been able to demonstrate that the material was slightly magnetic was to scatter a little of the fine powder on water, when the material floated very slowly and formed two clouds over the poles of a magnet. Yet, in an a.c. field it was repelled in the form of a halo, the distance between the pole and the inner diameter of the halo being about eight inches. Another slide showed the effect of a two-pole alternating-current magnet, forming two halos of the repelled material coalescing, whilst in another case a mixture of magnetite powder and specular hematite scattered over the single pole of an ordinary laminated alternating-current magnet showed both attraction and repulsion. Attraction and repulsion of the same material by an a.c. magnet was also illustrated. A two-phase magnet was used, with successive poles overlapping one another, giving the effect of a moving magnetic field, the forces overcoming one another, according as the field was weak or strong.

Hungarian Company Regulations.—*Reuter* reports that, by a decree recently published, all joint-stock companies in Hungary have been directed to arrange their future balance sheets on a gold basis—in terms of the new currency unit, the pengo (27.8 to the pound sterling). It is also decreed that a revaluation of the assets is to take place and companies with net assets of less than 50,000 pengo (say, £1,800) are to be wound up, unless they are companies with purely local interests, in which case the minimum will be 10,000 pengo. The nominal value of the shares in these companies is not to be less than 10 pengo; shares of lower value are to be amalgamated. Branches of foreign firms, insurance companies, and co-operative societies are subject to special provisions.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric Lawn Mower.

Fig. 1 is an illustration of an electric lawn mower which is marketed by the COLDWELL LAWN MOWER COMPANY, Newburgh, N.Y., U.S.A. The cutting and propelling operations are controlled by the motor and the steering is effected

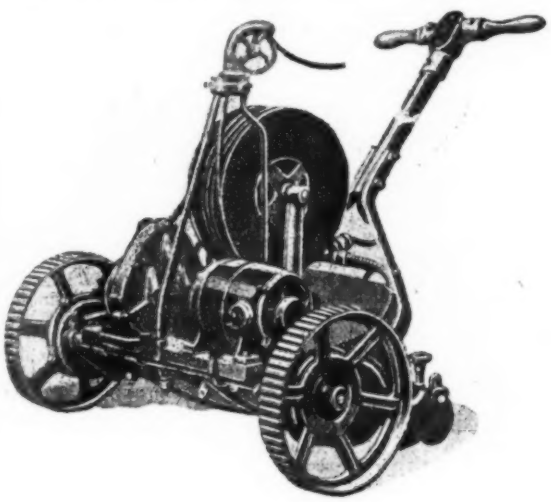


Fig. 1.—Electric Lawn-Mower.

by the operator. It is claimed to be practical, efficient and silent, and capable of dealing with a quarter of an acre in an hour. The machine is fitted with "Timken" tapered roller bearings, and the motor is designed specially for the purpose. An automatic reel takes up and pays out the supply cable.

A Street-lighting Unit.

The accompanying illustration, fig. 2, is one of the 400 G.E.C. "Paisley"-type street lamp posts equipped with lanterns and "Superlux" globes, which have been installed by the Paisley Corporation for the lighting of its secondary streets and roads. The post is provided with a hinged door at the base, inside which is accommodation for fuses, time switch, &c. The globe is 16 in. in diameter, and is suitably ventilated for a 300-W gasfilled lamp. At Paisley two 100-W lamps have been fitted in each lantern, and it is said that the resultant illumination is highly pleasing, free from glare, yet of sufficient intensity for side-street lighting. Two of these street-lighting units were shown at the recently-held electrical exhibition in Paisley. They are particularly suitable, it is claimed, for residential districts, as they combine efficiency with ornamental design. For this reason also they should prove particularly useful for such places as seaside gardens, &c., as they are practically all cast-iron. Credit for the layout of the Paisley lighting scheme is due to Mr. W. Blair-Smith, the Corporation engineer.

Fig. 2.—Paisley Lighting Unit.

An Automatic Stuffing Box.

We illustrate in fig. 3 a new type of stuffing box which has recently been marketed by the PULSOMETER ENGINEERING CO., LTD., Nine Elms Iron Works, Reading, and which is designed to overcome the difficulties that arise in centrifugal and other forms of rotary pumps when dealing with water containing grit or dirt. The box space is fitted with a bronze bush which is a sliding fit on the spindle and a driving fit in the bore of the stuffing box. A cast iron housing is held in position by lengthened gland studs. In the housing are fitted two hardened-steel sleeves which are caused to rotate with the spindle by means of a key. These sleeves are kept apart and in contact with the neighbouring faces by means of a helical spring which, incidentally, has the effect, it is claimed, of churning up the grease and allowing it to find its way through the space between the ends of the brushes or sleeves; the grease enters through this space and works along the spindle, efficiently lubricating it and preventing the ingress of dirty water. When fitted on a pump with a suction lift, the higher this lift the more effective, it is claimed, is the action of the packing because the grease is drawn more forcibly through the fine clearance between the shaft and the bush, affording continuous automatic lubrication. This keeps the working parts perfectly cool at the highest speed and the frictional losses are practically

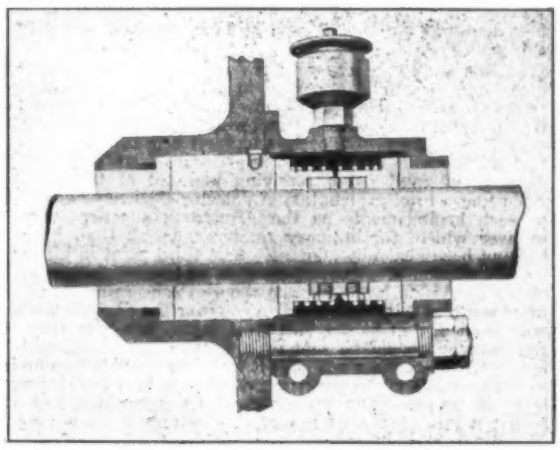


Fig. 3.—Automatic Stuffing Box.

eliminated. When the pump, instead of drawing its water, is fed from a positive head, it is essential that the grease in the housing should be fed into the gland at a pressure higher than that at which the dirty water enters the eye of the impeller so as to ensure the grease flowing in the right direction. Special lubricators are supplied for this purpose.

An Electric Hand Plane.

MESSRS. RENE VOLET, LTD., 242, Goswell Road, London, E.C.1, have put on the market the "R V" hand-planing machine, fig. 4. It is a wood plane in which the ordinary fixed steel plane is replaced by a rotary steel cutter. The latter is driven, through the medium of suitable pinions, by a 1.1 h.p. "R V" motor designed for use on both a.c. or d.c. The cutter is 4.75 in. wide and is capable, it is claimed, of rapidly rough-planing the hardest of woods with the minimum of effort, and

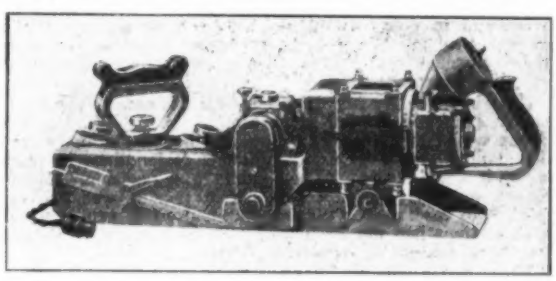


Fig. 4.—Electric Hand Plane.

when working on beech or oak, a cut of ¼ in. deep is readily obtained with a rapid forward movement. The rear part of the machine is always kept on an exact level with the rotary cutter, whereas the elevation of the forward part can be adjusted by means of a very simple mechanism controlled by an accurate vernier. The forward sole is used to limit the depth of the cut while the rear one ensures a thoroughly straight guidance and prevents the cutters from plunging or slipping. This construction is claimed to result in work of the highest accuracy.

A New Batten Holder.

We have received from MR. J. C. WHITE, 49, Bridge Street, Deansgate, Manchester, a sample of a new batten holder which he has recently placed on the market. It has been designed to meet the H.O. requirements and for use in basements, cellars, &c., where the head room has to be considered. The metal parts are embedded in a compound moulding which is claimed to be fireproof and shockproof. The connections are enclosed entirely in the base, which is covered by a back plate of the same material. A bonding ring renders it a convenient device for use on lead-covered cables.

Wireless Telephony.

Its Past, Present, and Future Possibilities.

(Résumé of popular lecture delivered before the INSTITUTION OF ELECTRICAL ENGINEERS *on January 7th.)*

CAPTAIN P. P. ECKERSLEY, chief engineer of the British Broadcasting Co., in a lecture on the above subject, said that his convinced opinion was that wireless telephony would play only a secondary part as a means of communication; its disadvantages would preclude its use to a very large extent for any but the great fundamental work of broadcasting. People in this country did not appreciate what a tremendous industry had already been built up. In the United States the sales of wireless apparatus last year totalled 500,000,000 dollars in value and doubtless we should have a similar annual turnover in this country.

As this was in the nature of a popular lecture, he began by explaining in general principles how broadcast telephony was achieved, and then explained how experience had shown that it was impossible to work two broadcast stations unless they were separated by 10 kilocycles in wave-length, and suggested that all the complaints about interference were really an indictment of methods of receiving and not of transmission. Following a brief explanation of detector efficiency he referred to such arrangements as the Armstrong super-regenerative receiver which, for ordinary receiving, thank God, he said, had not been generally adopted. As a third point in his popular explanation of general principles an indication was given of the Heaviside layer and the theories concerning it; of the proposals that had been made to get over the distortion which now existed, due to the Heaviside layer, one was that the transmission should be sent over a wide wave band and by means of three or four receivers it would be possible to combine the components at the receiving end and so cheat the Heaviside layer of its distortion properties. That suggestion had not been put into effect, but it would be extremely interesting as an ordinary straightforward experiment. Whilst a solution of the difficulty was being sought in terms of higher power and longer wave lengths (the scheme adopted at the Rugby station) others were endeavouring to secure the object in view by means of short waves, but it was certain that long-distance wireless telephony would never enter its wider field of development until a solution of this distortion difficulty had been found. Explaining a diagram of the usual method of controlling the output of high-frequency waves, in support of his statement, Capt. Eckersley said that in commercial sets it was necessary for the generator to be capable of sending out twice the power it was delivering to the oscillating system, and when they spoke of 1½-kW sets what was really meant was 3 kW, because whereas at one moment the power sent into the aerial would be double the normal, at other times it would be nothing. Modifications of the method of control were illustrated, notably that of the Western Electric Co., which added a high-frequency magnifier in order to achieve some economy, which possibly was achieved and possibly was not. Another method of control was introduced by Captain Round, of the Marconi Co., in 1919; it was not used a great deal at present and it had the disadvantage that it absorbed only one half cycle, and in doing so might produce a strong second harmonic. Still another was the grid-control system that functioned in some way which he had never yet heard thoroughly explained.

Captain Eckersley had intended to speak about duplex telephony, but time did not allow him to do so. Wireless telephony would be useful to link up land lines and small duplex installations would be useful adjuncts to landlines in places where it would not pay, or be possible to, lay a cable. Captain Round and Mr. Franklin had shown that it was perfectly feasible to work such a system. He had often wondered why such stations had not been used to a greater extent all over the world to link up scattered points.

Those responsible for broadcasting started full of hope and ideas, but with no money, and they had built up a system which had served as a model to the world; nearly every European nation had adopted a system "something like our own." Every listener, no matter where he might be, must be given a signal robust enough to operate his set because it must be realised that 10s. was worth as much in Aberdeen as in the metropolis. The B.B.C. started with eight stations, but it was found that about 50 per cent. of listeners were not served in the manner it was desired they should be. He had got into more trouble through talking about crystal areas, but the fundamental consideration was that if a signal could be received on a crystal set, it meant that local interruptions were negligible; thus the crystal had been taken as the popular criterion of signal strength and after the first experiences with the eight main stations, the B.B.C. set to work to make 100 per cent. of the country a crystal area. There were even now, however, two possible troubles: One was that broadcasting could never go on in a perfectly natural way until it was possible to satisfy the "grousers" by giving them two things to grouse about instead of one. Alternative programmes would not be a complete solution, because of the international situation which had now to be considered in relation to any national system. At the present time, a station in Rome might seriously interfere with transmission in London and, as a result, the multi-station idea would have to be abandoned in favour of fewer stations; because of the uses made of wireless outside broadcasting it was essential to get an international solution. If the 250 stations working, or in contemplation, in Western Europe were to work unhindered it would be necessary to make one station do the work of five or six, and that could only be done by using far higher power than was now the case. There were difficulties, however, because however much some countries might be willing to scrap their present stations and build new high-power ones, they were not rich countries and they might not feel it fair that they should be asked to do so. Therefore, the solution that had been put forward was that certain of the important stations should be granted exclusive wave-lengths to themselves and to arrange that certain of the others should work on non-exclusive wave-lengths. In this way, the limited number of wave-lengths would be made to go round. If two stations worked on exactly the same wave-length there would be no interference between them up to a distance of five miles; at a distance of 10 miles one would detect a faint background of mush, and at 15 miles there would be definite interference. Therefore, it was established that two stations in different parts of the country working on the same wave-length would only have local significance and only in their crystal areas would such local programmes be received. The difficulty of getting the fineness of adjustment between two such stations, which had to be of the order of one-hundredth of one per cent., must not be overlooked, but perhaps the new crystal, which could be ground to give that accuracy, would assist. The task confronting the B.B.C. as a transmitter was extraordinarily simple in essence, but amazingly difficult to achieve, because the aim was to transmit from a frequency of about 30 up to about 10,000 cycles with equal clearness at the receiving end; so far there was no method which could render sound a measurable quantity and, although there were the advocates of the pressure method of testing and the audibility method, he believed eventually they would arrive at something between the two; he wished someone would provide a means for measuring what was being done.

Finally, Capt. Eckersley discussed transformer design and indicated the attempts that have been made to secure a more or less straight curve. It had been said that the transformer was the worst possible piece of apparatus and that it behaved badly, but that was not so; if the transformer were designed properly, it could be almost as perfect as resistance-capacity magnification. One way of overcoming leakage was to make the load as small as possible, and a transformer for wireless work must be designed like a power transformer to get proper regulation the whole way; that should be borne in mind and be appreciated as a fundamental conception underlying the design of transformers. Showing a curve obtained with the type of transformer now being used for simultaneous broadcast work, Captain Eckersley said it showed that there was no difference between a properly designed transformer and the vaunted resistance-capacity coupling. This result, he said, had been obtained by a little trick which consisted of using a choke in the anode circuit and a condenser in series with the transformer primary. Regarding input transformers, by making the transformer equal to the mean impedance of the line, a compromise was obtained which had proved successful.

Discussion in London.

PROF. C. L. FORTESCUE, after complimenting Capt. Eckersley upon delivering the lecture in his own inimitable way, said that the engineers of the B.B.C. always had before them the goal of perfection, but they had never allowed the best to be the enemy of the good. Thus it was that a system had been built up which had been copied the world over. Although acoustics was not usually included in the ordinary term of engineering it was quite obvious now that it must be, and there were very few who would care to tackle Capt. Eckersley on the problems of acoustics. The general impression from the lecture was that the receiving end was the one upon which the greatest concentration was required at the moment, and from this point of view it was to be hoped that in the fairly near future it would be possible to obtain receiving sets which would be cheap, selective, and efficient. There were very few people in this country who could afford £100 for a beautiful imitation of a piece of old furniture, most of the interior being occupied by a raucous loud speaker, and therefore the great need was a set which had the advantages of good selectivity together with cheapness in first cost and in maintenance.

Mr. P. J. VOIGT said it must be admitted that the loud speaker was the weakest link in the chain, and the point to be determined was what a loud speaker was expected to do. Was it to give the effect of a man speaking in the room, or the effect of the sound coming, as it were, through a hole in the wall? He had experimented on the latter lines, but in working out his calculations of pressure, velocity, &c., he had made the mistake of assuming that the hole was infinitely big and that a comparatively small hole would give the same effect as a large one. Working on these lines he had built a loud speaker which unfortunately was not loud, but which reproduced tones that no other loud speaker had ever

done; the "s's," however, came through badly. He had then worked out another arrangement with the idea of faithfully reproducing the energy sent out from the microphone at the B.B.C. and, although he got a quality slightly better, he believed, than that actually sent out from the B.B.C., the idea at present was only an ideal. He argued along the lines of pressure rather than audibility and recently had developed a microphone which was practically an electric pressure gauge; with it he had obtained loud-speaker results which were the most natural he had ever heard.

Mr. C. M. R. BARLBI said it was well-known that stations did not trouble to transmit sounds of low frequency because the lower notes were not picked up by the receiving stations. That might be satisfactory for commercial work, but for ordinary broadcasting when so much music was transmitted, the lower notes could not be overlooked. Whilst this attitude might have been justified a year or two ago, the degree of perfection now obtained with receiving sets had changed the situation considerably and it seemed reasonable to demand that the B.B.C. should investigate this matter and obtain the views of listeners with regard to it.

Mr. E. H. SHAUGHNESSY (G.P.O.), referring to the statement that the turnover in sales of wireless apparatus in America now amounted to 500,000,000 dollars, asked whether the reason why they had not reached a similar figure in this country was Capt. Eckersley's "crystal" attitude, which had made it possible for everybody to make his own crystal set for half-a-crown. In connection with the congestion of wave-lengths and the suggestion that some system should be adopted of sending only on one half of the wave band, that was the method which was to be adopted at Rugby for the trans-Atlantic telephony experiments, and it was a method which had been explained to the Institution by Dr. Nichol, of the American Telegraph and Telephone Co. two years ago. He disagreed with Capt. Eckersley's statement that wireless telephony would only be useful for broadcast work; personally, he regarded wireless telephony as having a very wide field of application. It might well be that in the future wireless telephony would have to be relied upon to bridge long distances over water where cables could not be laid and there might even be an international agreement to prohibit wireless telegraphy and only allow wireless telephony, and so occupy the ether to a higher degree of efficiency. It must not be overlooked that wireless telegraphy was not cheap for long distances, because it cost a lot of money to run a big station. Whilst there were difficulties in having two or three stations working on the same wave-length, he should have imagined that it was an easily soluble problem, because there could be a land line connecting several stations with a master oscillator at one station to transmit the carrier wave for all the stations working on the same wave-length. He disagreed strongly with the implied suggestion of Capt. Eckersley that all reception and all loud speakers were bad, because if one paid a proper price it was possible to get a receiving set which would give almost perfect reception under present conditions.

Mr. D. KINGSBURY, speaking on quality of reproduction, said he thought the arrangement shown by one of Capt. Eckersley's slides by which a choke was used in the anode circuit and a condenser in series with the transformer primary was the answer to the "feathering" which was noticeable in the reproduction of certain notes in the bass region. This effect was particularly noticeable in connection with the drums and it was also noticeable in a certain announcer's vowel sounds. The horn as a means of amplifying the efforts of a small diaphragm would not be with them always; loud speakers would take the form of some large surface acting as an air motor.

Mr. S. BRAENDLE said he was using a form of cone loud speaker with which he was able to obtain the lowest notes in music, such as the double bass, or the drum, with equal clarity to the higher notes of the violin. There had been, however, one or two cases of unsteadiness which might be due to outside interference, or might be the same effect which Mr. Kingsbury had referred to as "feathering." He, however, was not inclined to blame the B.B.C., because he was using rectified a.c. and therefore was perhaps liable to some criticism.

CAPT. ECKERSLEY, replying to the discussion, said he had not wished to give the impression that transmission was so much superior to reception, because he was quite ready to admit that the problems of transmission were fewer than those of reception. It was, indeed, a little discouraging sometimes to feel that all one's best efforts to produce the best transmission were sometimes hideously ruined in the homes of the listeners, through no fault of their own, however. The point he always had in mind was that it would be a wrong policy to develop broadcasting on the lines of making it difficult to receive and it was for that reason that he had taken his "crystal" attitude, because if the owners of crystal sets could receive the signals then it was quite certain that the users of other sets would be well served, because the average crystal set was not selective. As to the suggestion that the B.B.C. was going to alter its wave-length, that statement was characterised by its inaccuracy. There was no intention of changing to 100, 110, or even 200 metres. Perhaps the difficulties of the B.B.C. might be better appreciated if Mr. Shaughnessy realised what his own position would be if the Post Office had no control over the receiving instruments in the homes of telephone users. The B.B.C. was compelled to proceed on the lines of compromise. He was surprised to hear Mr. Barlbi say that it was well-known that the B.B.C. did not transmit the lower notes, because that was not the case. Although, theoretically, there should be no interference if transmission took place on a half wave, there were practical difficulties in the way, and the receiver would not be selective enough. The land line idea for transmitting the carrier wave, as suggested by Mr. Shaughnessy, had been considered, but the trouble was international. In reply to Mr. Kingsbury, he did not think the circuit he had mentioned was responsible for the feathering effect referred to, and with regard to microphones he admitted that experiments were being carried out which might introduce some such effect. At the same time, unless the B.B.C. did experiment in this way upon the public, very little progress would be made.

Selling Electric Refrigerators.

A RECENT article in the *Electrical World* by a refrigerator manufacturer draws attention to a matter which, while at present little thought of in this country, appears to offer opportunities. The writer deals particularly with domestic refrigeration, and his remarks are reproduced below:—

It does not seem at all necessary that any drastic changes should be made in the present high-class refrigerator construction in order to render it adaptable to electric refrigeration, and the advisability of establishing a standard refrigerator—that is, with respect to size and form—is seriously questioned. Manufacturers would be more than pleased if only one style were in demand, but, despite the fact that every effort is made to keep the line as simple as possible, they are obliged, because of the various tastes of the public and the definite but non-uniform space allowed for refrigerators in homes, to produce about fifty different sizes and styles of refrigerators. Any one of these is adaptable to electrical refrigeration without material change. The prime necessity is that scientifically constructed refrigerators should be used at all times, either with ice or electrical refrigeration, and that this should be particularly insisted upon by mechanical-refrigeration manufacturers and the dealers through whom their products are distributed. A study of this problem would reveal that the idea of good refrigeration must be imparted to the public first and that of electric operation next. The first task should be backed not only by refrigerator manufacturers, electric refrigeration-unit manufacturers and electric utilites, but by ice companies as well. The latter have been worrying about the inroads upon their business by electric refrigeration, but if they can be shown that this plan will help their business by stimulating the use of more refrigerators in more homes, they will give increasing help to the electric refrigeration idea, in which utilities, the electric refrigeration-unit manufacturers and refrigerator manufacturers are particularly interested. The policy endorsed at the recent convention of the National Association of Ice Industries at Los Angeles to launch an intensive campaign to educate the public to use more household refrigeration is in the right direction. Co-operation of the ice manufacturers with the N.E.L.A. on a plan which, it is believed, is now being worked out, will be beneficial to everybody concerned. The electric refrigerator is acknowledged to be the greatest revenue producer for central-station companies that has been placed on the market for some time. Granting this, an almost unlimited amount of assistance can be rendered by these companies in placing the refrigerator before the public. This can be done by wide-spread publicity. Some electrical companies have started a scheme of advertising, applying the amount of money it costs to connect a new residence with the street lines to a fund for newspaper announcements covering every electric refrigerator that goes into a home already wired. This is a good start, but I believe they can afford to go much further and spend considerable money, not only in local advertising, but collectively in national publications in order to further this new application.

Electrically-operated Crossing Gates.—A description is given in the *Railway Gazette* of an example of electrical operation for railway-crossing gates which may be seen at Sleaford, Lincolnshire, where the L.N.E.R. crosses the Southgate Road. The crossing is protected by four 25-ft. gates connected to a common driving rod cranked up to the signal box and operated by a crab working a crosshead travelling along a double-threaded screw shaft. The operating mechanism and levers controlling the running signals are so interlocked that before the gates can be moved all the signal levers must be in the normal position. This protection is ensured by electrical detectors fixed to the respective gatehends. A 1½-h.p. series motor is geared to the controlling shaft, its speed and direction being controlled by the necessary equipment operated by the signalman. A friction clutch on the motor shaft prevents any damage to the gates by a continued pull when they reach their open or closed positions. The electrical equipment was supplied by Messrs. Thos. Broadbent & Sons to the L.N.E. Railway's specification, and was installed by the railway company's telegraph and signalling staff.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Super-Station Switchgear.

I was rather surprised to read the opinions expressed by Mr. G. L. E. Metz with reference to the above subject in your issue of January 1st.

I cannot agree with his statement that a comparison of the oil-circuit-breaker designs of the five main manufacturers in this country will reveal such a close similarity for a given rating.

This is borne out by a recent comparison of oil circuit breakers having approximately the same rated rupturing capacity, manufactured by five of our leading firms, presumably those referred to by Mr. Metz. In these designs the quantity of oil per phase varied from 9 gallons to 590 gallons, velocity of rupture from 4 to 9 ft. per second, head of oil from 8.5 inches to 26 inches, and length of break from 9 inches to 25 inches.

In addition, the tanks showed great variation in design, including rectangular, elliptical, and round tanks, the thickness of the walls varying from 0.375 inch to 1.25 inches.

Again, one manufacturer will pin his faith to Bakelite condenser-type bushings for the leading-in insulators, another to oil-filled porcelain insulators, whilst yet another considers compound-filled porcelain insulators to be the best. Each manufacturer gives apparently sound reasons for the choice of any particular design, but unfortunately it often happens that their opinions as to the principles underlying the operation of circuit breakers are very conflicting.

With regard to the external appearance of the containing structure of switchgear of similar type, I agree that there is a certain amount of uniformity in the various makes, but that is usually as far as the similarity obtains.

I am entirely in agreement with the writer of the article criticised by Mr. Metz, as regards the lack of unanimity of opinion on oil-circuit-breaker design. It is indeed probable that all the various makes would stand up to their *rated* duty more or less satisfactorily, but it is improbable that they would all have the same *actual* rupturing capacity.

C. A. Wilson.

Leeds, *January 4th*, 1926.

The Metering of Three-phase Power.

I regret that I have been unable to reply to "A Meter Superintendent's letter before, as, having been away from home during the holidays, I was unable to obtain my copy of your valuable journal.

I am in complete agreement with your correspondent regarding the fact that a two-element, 3-phase, 4-wire meter will give accurate results *provided* that certain conditions (which he mentions) are complied with. May I add that the condition $e1 + e2 + e3 = 0$ depends on the following:—

(1) That the voltages must be exactly equal.
(2) That they must be 120 deg. apart.
(3) That they are pure sine curves.

It is my contention that these conditions can be, and are, upset on a modern 3-phase supply system, and I therefore once more aver that the correct three-element system of metering should be employed. To say that one may know the circuit conditions is hardly sufficient since, as Mr. Malcolm has shown us in his recent article, these circuit conditions are likely to alter.

Since your correspondent has in his previous letter mentioned B.E.S.A. specifications, may I in conclusion add that the two-element, 3-phase, 4-wire meter does *not* comply with the B.E.S.A. meter specification No. 37—1919. (See paragraph 57.)

In reply to the last paragraph of your correspondent's letter, I regret that I am unable to publish the facts and figures which he asks for. To do so would mean my quoting *individual* practice and I feel sure your correspondent will appreciate my position and my inability to mention such matters here.

"A Meter Engineer" is to be congratulated on his excellent contribution. He, without doubt, deals admirably with many of the important points on this subject.

H. Hugh Jaques.

London, *January 4th*, 1926.

Electric Wiring.

I read with interest "Polyphase's" letter in your issue of October 16th. I note his remarks with regard to plumbers doing electrical work; I am aware of that practice, as I served my apprenticeship as an electrician in Scotland, but conditions are totally different "out here." Take, for instance, a wireman or electrician arriving at Wellington and seeking employment with a contractor; this employer dare not employ him until he applies to the City Council for a licence, as the examinations are held every six months. If he can satisfy the local electrical engineer as to his experience and apprenticeship, he will be granted a "Provisional Licence" until the examination; then he will have to go through a theoretical and practical examination. At every new town he goes to throughout New Zealand he will have to obtain a "ticket"; in fact, there is a township approximately eight miles from Wellington called Lower Hutt, and neither of the supply authorities recognises the other's ticket. There is some word of a "National ticket" coming into force next year—the sooner the better. Now take the employer's side; should he be a master plumber and desire to commence wiring, he will be barred throughout New Zealand from doing anything. He has only one resource and that is to employ an electrician holding a master's certificate (note, not a wireman's ticket as explained above; the "master's" is much harder to obtain). So you will see what the plumbers in this country have to contend with; well, why shouldn't they?—"one man one job."

When the contractor obtains any wiring job, from one point upwards, he dare not commence it until he gets a "permit" from his Power Board to commence work; the same thing applies to alterations and extensions of old installations. I should like to see some of the "knights of the gas pipe" in the old country under our regulations out here. I admit that at first I did not care too much for the N.Z. regulations, but after residing in New Zealand for two years one gets used to these things, and now I congratulate the Government and fire-underwriters of N.Z., as your readers will see that no one but an experienced licensed wireman or electrician dare do any installation or electrical repair work. I may add that the sooner the supply authorities in Britain adopt some method like that of the Dominion of New Zealand the better it will be for them and electrical contractors, as well as for all competent persons employed in the electrical industry. I think the electrical contractors in Scotland and England would not miss the plumbers if they were barred from doing electrical work. I have often attended E.T.U. meetings in Scotland over the plumber question. I would be glad to hear from "Polyphase" or any other of the REVIEW readers. I have read the REVIEW for years now—I look forward to getting it out here. I may add I hold the master's certificate for electrical work. Wishing the REVIEW the best of success.

S. J. M. Ewart.

Hastings, N.Z., *December 7th*, 1925.

An Electric Vehicle Association.

Having informally discussed the present stage in the progress of electric propulsion by electric storage methods, I feel that now is the opportune moment for seriously considering the immediate formation of an Association, Institution, or Society consisting of those who are interested in any way whatsoever in electrical vehicles (*e.g.*, road vehicles, tractors, trucks, locomotives, launches, barges, &c.), whether they be manufacturers, electricity supply engineers, owners, or users thereof.

Let such representation at periodical meetings where the progress in other countries would be reviewed, and papers read evoking free discussion, not only would the members benefit by exchanging opinions and so forth, but the interest of the general public would be aroused by the lay Press reports of the proceedings of an institution devoted solely to the subject of electrical transport for both passenger and goods traffic.

I am already assured of some support from those who fully appreciate the advantages which will accrue from the inauguration of such a society, but I would like to hear the views of your readers if they will kindly communicate with me direct, as I am arranging for an informal meeting at an early date to discuss formation details.

J. C. Elvy.

3-7, Southampton Street, London, W.C.2.
January 7th, 1926.

Meetings of the Institution of Electrical Engineers.

Those who heard Captain P. P. Eckersley's brilliant lecture on Thursday last were entertained in a manner seldom known at a meeting of the I.E.E. I wish, however, to enter a protest against an ordinary meeting of the Institution being devoted to a popular lecture, especially in view of the fact that the amount of time allotted to the discussion of the excellent papers by Captain P. Dunsheath and Professor S. Parker Smith was most inadequate in each case.

With the greatest respect, I suggest that the Council of the I.E.E. appears to be in danger of being carried away by the "Radio Flood" which is sweeping through this country at the present time; and I trust in future the ordinary meetings of the Institution will be restricted to the reading and discussion of engineering papers and to scientific lectures.

H. C. Silver.

Ewell, Surrey, *January 8th*, 1926.

Agricultural Electricity in Germany.—A special "Electricity in Agriculture" section is being organised in connection with the "Green Week" Exhibition to be held in Berlin from February 20th to 28th next. The section is being organised by the Union of Electricity Supply Companies in conjunction with the German Agricultural Society, and it is intended that the exhibits shall be of a comprehensive character to demonstrate the various directions in which electricity and electrical appliances can be advantageously used in connection with agricultural operations.

Reviews.

British Wire-Drawing and Wire-Working Machinery. By H. DUNELL, A.C.G.I., A.M.I.Mech.E. Pp. xv + 188; figs. 181. London: Constable & Co., Ltd. Price 21s. net.

This book forms one of the well-known "Engineer" series of volumes dealing with what may be termed the more or less specialised branches of the engineering industry. The wire-drawing industry and that of the design and manufacture of wire-working machinery are perhaps more specialised than most, and the author in his preface confesses that he often found a difficulty in obtaining information from manufacturers regarding certain phases of his work. Despite this, however, he has succeeded in getting together a fairly comprehensive account of the various ramifications of the trade, which after appearing as a series of articles in our contemporary *The Engineer*, is now issued in book form in the hope that it may help towards a greater interchange of knowledge among the individuals directly and indirectly concerned in the wire industry to the ultimate betterment of the trade.

The importance of the wire industry can be gauged from the fact that in this country alone, it consumes roughly three-quarters of a million tons of steel annually—very little iron wire is now made—and about half as much of the non-ferrous metals, including, of course, copper which is used in the manufacture of electric cables and transmission lines, although whether copper conductor of large size, such as is used for overhead tramway trolley wire or in armature construction, is included in this total does not appear from a study of this book. It is of interest to note further that apart from its intrinsic value, the wire industry is regarded in the United States and on the Continent as a vehicle for the consumption of large quantities of steel and is associated with and fostered by the steel industry in consequence. The manufacture of wire and of machinery for making wire goods, although they are highly specialised industries, are of particular interest to electrical engineers, first because of the fact that copper wire enters so largely into every branch of the electrical industry, and, secondly, because the complex and often very heavy machinery used in the wire industry is largely driven by electric motors and the driving of this machinery is often a problem demanding intimate knowledge of the conditions involved. Thus, in the course of a description of a works in which the wire rods are made, this forming the first stage in the manufacture of wire, it is stated that an electric motor of 2,750 h.p. is employed. This gives some idea of the extent to which power is utilised in the wire-making industry.

The ground covered by the author can be roughly divided into two parts, the first dealing with the manufacture of the wire itself and the second with the manufacture of various articles from wire. The production of the wire involves the manufacture of wire rods, of the various kinds of dies and wire-drawing blocks, and of the machines for the drawing of the wire, as well as straightening and cutting off in required lengths. The various processes involved are described in detail and a large number of illustrations and drawings of both the machinery and its essential parts are given. In fact, it may be mentioned that the illustration of the text is a notable feature of the book and one on which both the author and the publishers are to be congratulated. With reference to the second part of the book in which the conversion of wire into manufactured articles such as springs, chains, &c., is described, readers of the ELECTRICAL REVIEW will be particularly interested in the chapter dealing with electric cable making. It is indicative of the highly specialised nature of the wire industry that in this branch, as in many others, the manufacturers of the articles are also the designers and makers of the machinery which is used in the manufacture of the articles. An interesting process of which a description is given in this part of the book, is the flattening of wires from round to square or rectangular section, this being found cheaper than drawing the wire to the required section. The machines which have been developed for this kind of work are described and illustrated and it is apparent that their use leads to cheaper manufacture for certain classe of products. This is a process which is capable of being increasingly employed in the electrical industry.

Although, as his title suggests, the author deals particularly with British-made machinery, he occasionally refers to what is being done in other manufacturing countries, from which it is apparent that the wire industry is one which is considered all over the world to be of such great importance as to be worthy of careful study. We recommend this book to all who are interested in the industry in this country, particularly to those who realise that by the use of improved machinery it is capable of being still further developed.

The Elements of Internal-combustion Engineering. By TELFORD PETRIE, M.Sc., Assoc.M.Inst.C.E. Pp. xi + 236, with 62 diagrams. London: Longmans, Green & Co. Price, 10s. 6d. net.

The internal combustion engine has already become a prime mover of considerable importance to the electrical engineer. For the development of small amounts of electrical energy in isolated districts where current from a central supply is not available, no unit is more efficient than an oil engine directly coupled to a dynamo, and where larger powers are required, as in the electric generating stations of country towns, the Diesel engine-driven generator having an output of anything up to 1,000 kW is becoming recognised as the most economical form of unit available. The use of the Diesel engine as a stand-by and for dealing with the peak load of a hydro-electric installation is also of considerable commercial importance. For larger outputs, this type of engine cannot compete with the steam turbine when considered from the broad standpoint of commercial operation, but under special circumstances it is not unlikely that the internal combustion engine with its superior thermal efficiency might prove of considerable value. Thus, in dealing with the problems of coal conservation in this country, it is often urged that instead of burning raw coal it should be first of all subjected to distillation at low temperature in order to obtain the valuable by-products in the form of oil and ammonia. In this process of distillation certain quantities of gas are obtained and it is almost essential to the financial success of the scheme that some use should be found for this gas. It has been suggested that it could be employed to operate large gas engines which, in turn, would drive large electricity generators, the latter delivering their energy to a ring main connecting the various collieries where the distillation process is utilised. Other possible developments of the use of the internal combustion engine for the generation of electrical energy could be given, but sufficient has been said to indicate not only the present importance but the possibly even greater importance of this type of engine in the future to the electrical engineer.

In the book which lies before us, Mr. Telford Petrie has dealt with the theoretical aspect of the various types of internal combustion engine which are available at the present time and he has even ventured to suggest certain developments which may occur in the near future. The whole work is admittedly dealt with from the point of view of the student, but it does not necessarily suffer on that account, since one need not be young or go to a technical college to realise the importance of studying the development of any new phase of engineering science. After an introductory chapter in which the history of the internal combustion engine is briefly reviewed, the author gives a description of the various forms of gas engines and their cycles of operation, this being followed by a similar treatment of the various kinds of oil engines, *viz.*, petrol and paraffin engines and the heavy-oil engines, or the Diesel and semi-Diesel engines as they are often termed. In both of these chapters the most recent types are mentioned, including double acting engines, the Still engine and the Humphrey gas pump, simple outline diagrams being given of each type with, in many cases, indicator diagrams corresponding to the different strokes of the piston. The more theoretical aspect of the various cycles of operation is then studied in detail, such problems as the ideal efficiency, efficiency ratio, mean effective pressure and consumption of the ideal cycles being considered. This part of the work is prefaced with a brief outline of the theories of thermodynamics and the physical properties of a perfect gas. Considering next these theories in their relationship to the actual performance of an internal combustion engine, the question of the variation of the specific heats of a gas is dealt with and this is followed by the familiar treatment of the subject of entropy in so far as it deals with the problem of the energy developed during the cycle of operations in the cylinder of a gas or oil engine. The problems of ignition and combustion are next discussed, and finally the author gives a valuable chapter on temperature effects in which the important problems of jacketing, temperature stress and loss of strength of metals due to high temperatures are investigated. The volume concludes with a brief discussion on the possibilities of development in which the question of other cycles of operation and the internal combustion turbine are investigated. There are also a number of examination questions with answers grouped at the end of the book under the headings of their respective chapters and a comprehensive index is appended.

The whole work has been carefully produced, the diagrams are most informative—although some of them might perhaps have been reproduced to a rather larger scale—and no attempt has been made to unduly compress the various mathematical investigations, so that the working is always easy to follow. This is a book which should be in the hands of not only the student at the technical college, but of every electrical engineer who is desirous of understanding the theories underlying the design and operation of the very many different types of gas and oil engine which are being used for driving electrical generators.

Alternating Current Problems. By R. E. BROWN, Assistant Professor of Electrical Engineering, Moore School of Electrical Engineering, University of Pennsylvania. Pp. viii +84; figs. 16. London: Chapman & Hall, Ltd. Price 6s. net.

This little volume comprises a collection of examples, for the most part of a numerical character, arranged to illustrate the fundamental principles encountered in studies of the flow of alternating currents and of alternating-current machines. In the early part of the book special attention is devoted to the trigonometrical and symbolical methods of representing alternating quantities and many excellent and varied examples are included which will ensure a good and flexible knowledge of this important branch of electrical work to those who systematically work through them. The later part of the book,

which is mainly concerned with examples on generators, motors and transformers, is perhaps hardly so interesting as the earlier part, since the majority of the examples are of a more orthodox nature, nevertheless a wide range of work is covered.

The chief criticism we have to make is that, with isolated exceptions, no answers are given to the numerical examples. Students taking advanced work of this nature are not likely to delude themselves or others by making improper use of the answers, and, on the other hand, the answers would oftentimes be of very real help to those who have no opportunity of turning to an instructor for aid. It should perhaps also be mentioned that a small proportion of the examples will not be of great interest to English readers since they depend on an acquaintance with the Standardisation Rules of the American Institute of Electrical Engineers and are concerned largely with facts rather than with principles.

Teachers of electrical engineering are well advised to allow their students to work as great a variety of numerical exercises as circumstances permit and few teachers will fail to find new ideas relating to problems if they peruse a copy of the book under notice.

On the Road. By W. H. BEABLE. Pp. 115. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 5s. net.

Most of us have met commercial travellers of one kind or another. They have appeared in fiction and, occasionally, in caricature. They are to be seen in the train, and, less often perhaps, at the club. Many of us meet them in the course of business, and draw our impressions from that. But few people could give a very clear idea of them as a whole and of their work as a profession. The different types of men grouped together under the heading of commercial travellers seem to have so little in common, that only a rough conclusion would appear possible.

But the author of this book draws some very definite conclusions. He is not afraid to insist on the plain virtues of hard work and sobriety, truth and honesty. He asks the reader to do no more than he himself has done, and the following passage will give an insight into the style of the book and the character of the man.

> "I had an appointment with a gentleman to discuss the question of selling Hungarian wines in this country, a subject on which I knew nothing whatever. I looked up Hungary in my encyclopædia, read all about the hills and dales where the grapes were grown, and the methods employed in the cultivation and production of wine. Then I turned up "wine" and became familiar with their peculiar properties, how they compared with French and other wines. Thus armed for the interview, I was able to discuss the subject so intelligently that my interviewer was quite astonished to learn that I had never been to Hungary, and had never been associated with the wine trade."

That is the way he talks from page to page through the book, for his style is simply good talk transferred to paper. His instances are best when drawn from his own experience. One or two of his quotations are less apt. For example, an employer asking a brisk young manager what the noise was outside would scarcely expect to get such a wordy reply as one story says he got

The book is, however, so readable that there is no need to magnify a solitary fault or two. One prefers to draw notice to its fluent and lucid English—a rare quality in books on commercial subjects. Some of the subjects dealt with are "The Salesman's Contract," "Selling Advertising Space" and "The Sales Manager." A bold commercial, genuinely dissatisfied, might lend it to his employer, in the hope that he might read about "Choosing an Employer." This chapter is something new in commercial literature.

The book is good value for 5s., but one hopes it may soon be possible to issue a popular edition so that juniors may share its good things along with those who are already on the road.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 6th:—

Day-Fan (lettering and design). No. 459,153. Class 6. Electric fans, electric motors, and parts thereof.—Dayton Fan & Motor Co., Dayton, O., U.S.A. (British representatives: White, Langner, Stevens and Parry, Jessel Chambers, 88-90, Chancery Lane, W.C.2.)

Combine (lettering and design). No. 462,791. Class 8. Variable electrical condensers and parts thereof.—Somco, Ltd., 1-11, Larch Road, Balham, S.W.12.

Salient (lettering and design). No. 462,958. Class 8. Scientific instruments and instruments and apparatus for use in radio-telephony.—S. A. Cutters, Ltd., 18, Berners Street, W.1.

K. (lettering and design). No. 463,682. Class 9. Electrical measuring instruments.—Beckett & Parker, 157-159, Summer Lane, Birmingham.

Lisensola. No. 464,071. All goods in Class 8.—Lissen, Ltd., Richmond, Surrey.

Brinford. No. 464,825. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—A. G. Brini, 63, Chelmsford Road, Woodford, E.18.

Elmah. No. 462,469. Class 11. Electric massage apparatus.—Hoare and Co. (Engineers), Ltd., 70, Old Broad Street, E.C.2.

Staba-Larc (lettering and design). No. 464,449. Class 12. Electrodes of ordinary metal.—Allen-Liversidge, Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

14,766. "Electric stoves for use in the enamelling of electric conducting wires." V. Planer. June 18th, 1924. (244,501.)

21,681. "Electric condensers for neutralising capacity coupling between parts of electric circuits." Hazeltine Corporation. February 20th, 1924. (229,625.)

21,799. "Induction motors." P. K. Sen. September 15th, 1924. (244,511.)

21,802. "Metering in automatic telephone systems." Siemens Bros. and Co., Ltd., and J. Berry. September 15th, 1924. (244,512.)

21,879. "Sound recorders, sound-amplifying devices, and microphones." W. S. Purser. September 16th, 1924. (244,516.)

22,053. "Variable inductance devices." Igranic Electric Co., Ltd., and A. H. Curtis. September 18th, 1924. (244,525.)

22,312. "Spacing of plates of variable condensers." British Thomson-Houston Co., Ltd. (J. M. Enders). September 22nd, 1924. (Convention date not granted. Addition to 212,305.) (222,149.)

22,753. "Electric batteries." W. Peto, H. M. Genese, and Pritchett and Gold & E.P.S. Co., Ltd. September 26th, 1924. (244,540.)

23,944. "Automatic electric circuit-breakers." E. M. Johnson and Metropolitan-Vickers Electrical Co., Ltd. October 9th, 1924. (244,548.)

24,129. "Transmission of wave energy for high-frequency signalling." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co. Inc.). October 11th, 1924. (Addition to 243,088.) (244,552.)

27,240. "Receivers for wireless telegraphy and telephony." C. Seymour, G. A. Irving, and J. C. W. Drabble. November 14th, 1924. (244,568.)

27,847. "Means for balancing telephone cable circuits." A. H. De Voogt. November 23rd, 1923. (225,229.)

28,583. "Electrically-heated appliances." P. M. Edinborough and Metropolitan-Vickers Electrical Co., Ltd. November 28th, 1924. (244,574.)

29,012. "Control of electric motors." British Thomson-Houston Co., Ltd., and E. B. Tuppen. December 3rd, 1924. (244,576.)

29,084. "Device for holding coils for wireless apparatus and like purposes." G. Gosden. December 4th, 1924. (244,577.)

30,773. "Electric relay systems." British Thomson-Houston Co., Ltd. December 29th, 1923. (226,813.)

30,953. "Electrical measuring instruments for alternating-current circuits." Metropolitan-Vickers Electrical Co., Ltd. January 2nd, 1924. (227,104.)

31,000. "Insulation removing devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (F. Doring). December 29th, 1924. (244,586.)

31,140. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). December 29th, 1924. (244,587.)

31,224. "Electromagnetic relays." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). December 30th, 1924. (244,591.)

31,231. "Telephone head-sets." A. Milledge. December 30th, 1924. (244,592.)

1925.

225. "Inductances and auxiliary apparatus for electrical measurements." A. Campbell. January 3rd, 1925. (244,596.)

2,032. "Crystal detectors for wireless reception." E. E. Rooke. January 22nd, 1925. (244,604.)

3,181. "Method of indicating frequency changes in alternating electric currents." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). February 4th, 1925. (244,607.)

3,503. "Self-excited induction motors." British Thomson-Houston Co., Ltd. February 9th, 1924. (228,937.)

4,263. "Electric drive for transmission gear-operated high-tension electric switch apparatus." Maschinenfabrik Oerlikon. February 14th, 1924. (220,348.)

6,916. "Electric discharge tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. June 4th, 1924. (235,141.)

7,479. "Electrically-controlled lifts." J. Fothergill. March 19th, 1925. (244,621.)

9,142. "Vacuum tube." F. R. Geyser. April 6th, 1925. (244,628.)

10,168. "Compensated alternating-current machines of the kind having a commutator winding." Sachsenwerk Licht-und Kraft Akt. Ges. October 31st, 1924. (Addition to 231,895.) (242,221.)

10,863. "Multiplex telegraphy." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). April 25th, 1925. (244,635.)

11,910. "Thermionic valve systems." Edison Swan Electric Co., Ltd. May 7th, 1924. (233,718.)

13,920. "Control of alternating-current motors, particularly induction motors." P. C. Rushen (Hazeltine Research Corporation). July 4th, 1924. (Convention date not granted. Divided application on 218,675.) (234,822.)

14,192. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. May 24th, 1924. (234,841.)

15,751. "Electrodes for electric furnaces." B. E. D. Kilburn (Norske Aktieselskab for Electrokemisk Industri). January 5th, 1925. (Convention date not granted. Divided application on 227,821.) (235,894.)

16,124. "Connector hooks for use in electric distribution systems." British Thomson-Houston Co., Ltd. September 16th, 1924. (240,129.)

16,129. "Electric shunts for instruments or other devices." British Thomson-Houston Co., Ltd. (General Electric Co.). June 22nd, 1925. (244,657.)

16,258. "Wattmetrical element for electric meters of the induction type." M. R. Fichter. June 24th, 1924. (236,215.)

17,883. "Thermostats." Metropolitan-Vickers Electrical Co., Ltd. July 11th, 1924. (236,960.)

17,908. "Electron discharge devices." British Thomson-Houston Co., Ltd. July 17th, 1924. (237,248.)

21,383. "Rotors for electrical machines." Siemens-Schuckertwerke Ges. August 27th, 1924. (239,214.)

21,626. "Method of manufacturing uniformly-loaded conductors used for signalling purposes." Felten & Guilleaume Carlswerke Akt. Ges. September 1st, 1924. (239,232.)

21,957. "Process for the manufacture of tubular electric incandescent lamps known as 'strip light' lamps." General Electric Co., Ltd. March 11th, 1925. (244,682.)

22,524. "Electrical liquid-heating apparatus." J. A. Law (W. E. Hudson). August 14th, 1924. (Divided application on 19,236/24.) (244,683.)

26,210. "Electric pulley tackle." O. R. Jurgensen. October 25th, 1924. (241,904.)

26,353. "Electric arc welding and apparatus therefor." British Thomson-Houston Co., Ltd. October 24th, 1924. (241,914.)

27,301. "Electrolytic cells." British Thomson-Houston Co., Ltd. November 10th, 1924. (242,682.)

28,061. "Electrodes for electron discharge devices." British Thomson-Houston Co., Ltd. November 8th, 1924. (242,662.)

29,918. "Electrical connectors." J. D'A. Clark. June 11th. (Divided application on 244,136.) (244,388.)